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BRIEFLY TOLD.

THE FIRST STEPS TAKEN BY THE COMMITTEE ON WORLD'S FAIR, AMERICAN ASSOCIATION.—We are in receipt of the following concise statement respecting the preliminary move of the Committee appointed by the American Association at the New York meeting last October, to secure concerted action of the gas interests in the matter of an appropriate display at the coming World's Fair:

CHICAGO, Dec. 3, 1891.

The Committee of the American Gas Light Association, to take steps to secure from the World's Columbian Exhibition space and facilities for a creditable exhibit of the gas industries of the United States and Canada, met in Chicago, December 1st, at the call of the Chairman, Mr. William McDonald.

There were present, besides Chairman McDonald, Messrs. A. D. Cressler and H. M. Hubbard, Secretary. The original Committee of seven lost by resignation Messrs. T. J. Hayward and Geo. Shepard Page. Three, therefore, constituted a majority. Diligent work for three days, in the face of many obstacles, secured for the Committee a great deal of information, and a most courteous reception, from the Director-General, Col. Davis; the Chief of Construction, Mr. Burnham, and various members of the Grounds and Buildings Committee, besides Department Superintendents.

As a result of their deliberations the Committee presented a formal application for a separate building, accompanied by their strongest plea for thus showing in operation the various processes of making gas, urging that, concentrated, an exhibit of the gas industries would be instructive, useful, imposing; that, separated, under minute classifications, the various exhibits would be very insignificant.

Very soon an appeal will be made to all manufacturers of gas appliances to make applications through this Committee for space, with a definite statement of what they will do.

Had the various manufacturers been through our experience of three days, it would be needless to urge upon them the necessity of co-operation in this matter. Independent action at this stage will be met with failure; by co-operating heartily an exhibit which will be a credit to our great industry may be secured.

HENRY M. HUBBARD, Secretary. WM. MCDONALD, Chairman.

THE LESSON OF IT.—From the concise wording of this preliminary message from the Committee it will be easily deduced that the Committee thoroughly appreciates the task that is before it, and it is also a token from its timeliness that the Committee understands that the preparatory days are lessening in number. It is to be regretted that Messrs. Hayward and Page could not find it possible to give of their time and counsel to the work in hand, but their prompt declination to serve, when they were unable to acquiesce in their appointment, is eminently characteristic of their business-like methods. While not knowing that such is the case, we presume the vacancies have been filled, and that the Committee is again intact. In any event, Chairman McDonald, and he is peculiarly well fitted to hold the Chairmanship of such a Committee, from the fact that he is entirely free from what might be termed alliances that might or would lead to "tangles," has not permitted time to pass without putting a foot forward. The Committee's plea for co-operation is the keystone of the arch upon which the gas exhibits at the Fair must rest. Without co-operation, hearty, lasting and comprehensive, the showing made at the Fair on account of our common industry will be but the shadow of what it can be and what it ought to be. The Committee is to be congratulated on its promptness, and on the animation that evidently pervades its purposes.

ANOTHER TURN IN THE STANDARD COMPANY'S TIDE.—The troublesome tides that ebb and flow in the business sea of the Standard Gas Light Company of this city are as unrestful as ever; in fact, the marks

between mean low and mean high water up around Pleasant avenue and in the neighborhood of upper Courtlandt street show greater differences each day. To put it bluntly, the Company appears to be suffering, and severly, too, from an overplus of Managers and Engineers-in-chief; although it must be said that this overplus is not anything new in the Company's history—it existed in the Spinola-Bottsford days of old as it does now in the current Bostwick-Terry-Nevins-Ludlam days. Chronic, then, it must be with the Company to have a superabundance of management and a deficiency of system; but we hope that in time the disease will be stayed, even if its earlier ravages can never be wholly eradicated. Last summer Mr. Frederic Egner entered upon the engineering management of the Company's works with the distinct understanding that he was to have sole control of the men for whose actions he was responsible. A pretty well-organized clique among the workmen existed, and it was not long before the Engineer made up his mind that some of them would have to go, if the discipline of the works was to be maintained, and some of them did go. The spirit of unrest and insubordination pervaded many of those who remained, and when the troubles with Rosenheimer and the latter's inciting of the Health Board, were at their height, the malcontents lost no time in harrassing the Engineer by their neglect of his orders. Finally it came to Mr. Egner's ears that a plan was underway, in case he dispensed with any further of their number, to stop the works by means of a strike without a word of warning. Mr. Egner collated his facts and placed them before the Board of Directors, adding the suggestion that were authority given him he could, by bringing on from St. Louis men whom he knew and could trust, insure the Company from the consequences of any strike that the malcontents might inaugurate. The Board assented, agreeing to give the St. Louis men work and to pay the expense of bringing them to New York. Mr. Egner engaged the men and they came on. Shortly after their arrival the Health Board ceased its onslaught on the Company, and things took on a look of peace. The malcontents, however, seeing that the end of their day drew high, laid siege to the ears of one of the many "managers" of the Company, demanding that if the St. Louis men already employed were not discharged, and that work should not be given to others who were about to go on the pay rolls, they would stop work and keep the others from working also. The threat was sufficient. The Manager ordered the discharge of the St. Louisans, whereupon Mr. Egner resigned (on the 4th inst.) from the service of the Company, and his resignation was accepted. These are the facts.

FRED. PERSONS MOUNTS THE LADDER.—Genial, rotund and honest Fred. R. Persons, who represented at Chicago the Western branch of the business of Messrs. John J. Griffin & Co., of Philadelphia, has been called up higher. He will hereafter be connected with the naphtha department of the Standard Oil Company, Western branch, the conduct of which is under the immediate supervision of Mr. C. M. Higgins, so well known amongst the Western fraternity, through his long residence amongst and his close contact with them during his administration at Cleveland. Mr. Persons' home address will be 2726 Monroe street, Toledo, O.—after all, he clings pretty closely to our own Faben—but that he will still be of the boys and with them goes without saying. While we congratulate his new employers on having secured Fred.'s services, we remember that Messrs. John J. Griffin & Co. have lost them, but as honorable ambition is not to be thwarted, and as the relations between his former employers and himself are as unstrained as ever, we doubt not that they heartily join with all in the belief that Fred. will have the best of success in his new field of duty—a belief that virtually is a surety, if alertness, application, steadiness of purpose and sterling honor can point the way to forming a belief.

SPECIAL WESTERN CORRESPONDENCE.

By SUNSET.

Dear JOURNAL: The example of arbitrary action against the local Gas Company so prominently followed of late in Cleveland, has imitators elsewhere. The latest is in Evanston, a town north of Chicago, and wherein the local Gas Company has always (according to its legal statement, the outgrowth of the action in question) conducted its business "in a quiet and orderly manner."

It seems that, from making all water gas, and having no ammonia to collect, the Company has heretofore let its drainage go off in the common public sewer. Of late, water gas tar has so appreciated in value that all the tar made has been caught in tar tanks and sold. As is well known, if Mr. Brown, the Superintendent, is particularly strong in anything, it is chemistry, and so carefully has he perfected his system of tanks, for the saving of all his bye-product, that nothing but water runs off, so clear that one would almost drink it, and having but a faint odor to indicate its gas works source. However, Evanston is one of those alleged modern perfect towns in which "Village Improvement Societies" and Prohibition bodies flourish, and its cultured officials determined that the Gas Company's water was objectionable, and forthwith, without any adequate warning, deliberately destroyed the Gas Company's main sewer connection, and by force prevented its being made again. Had the gas supply given out that night it might have been but a just retribution to the city. However, the gas folks tided over temporarily and immediately secured an injunction * against interference with their sewer rights. So the case stands at present. It is said to be a wilful and malicious attack against the Gas Company, and if so, I should not be surprised to see the Company vigorously hit back by a suit for damages against the city. Its grounds for such are said to be most tenable.

Another Gas Company is being attacked, but in this instance somewhat differently; and as, moreover, it is the celebrated ally of the Economic Company, which is trying to pipe natural gas to Chicago, from Indiana—presumably to carry out its fuel gas promise!—the amount of sympathy it will receive is problematical. On the fourth inst., representatives of all the natural gas companies of Indiana, met in Indianapolis, and practically agreed on a united basis of action for conserving the natural gas product, for adopting the meter system, etc.; and still more, for fighting the taking of natural gas from the State, by the Chicago Pipe Line Company, at all costs.

Every company represented agreed to this latter proposition, and the expense attached is to be pro rated among them all. Verily, the Economic's and its allies difficulties are at home and abroad as well, and to tunnel an old canal is one of the least of them.

I recently was posted concerning a brilliant idea for gas holder construction—something to avoid the expense of sending an expensive gang of men to erect, at a long distance, some diminutive holder.

This inventor who hails from Iowa, would get out iron holder sheeting in continuous strips, on rolls so that a gas man could buy it very much as one would buy a roll of barbed wire fencing. A ready fitted framework, when put together, would be covered by this sheeting in a spiral, climbing around and around to the top. A patent tin roofing style of crimped edge was a feature, and, after hammering it down, there you are! Every man his own holder builder, and buy the materials like wallpaper.

Over in St. Louis, though, they have a device that is a good one; in fact, Mr. Chollar—he of Topeka—has rigged up a little box about 7 feet long by 30 inches square, that literally knocks the tar completely out of from 1 to 1½ miltion feet of gas daily.

So efficiently does it do its work that I am told he sits by the hour listening to it, and thinks of moving his office over near it. The funny part is that after it was all made and running he discovered he had reinvented in effect the Cathell's scrubber described in "King's Treatise"—where any one can find out all about it. But that does not lessen its good work any. Its work sort of averages for the having 80 benches of 3's still in operation in A.D., 1891, in a works the size of St. Louis.

The Market for Gas Securities.

Consolidated gas is very strong, the opening price to-day (Friday) being 97¼ to 97½, which is, of course, ex-dividend of 2½ per cent., payable on the 15th inst. On the corresponding Friday of 1890, the opening price was 89½, so that those who got in at that time have had 5½ per cent. interest on their investment, and a speculative increment of value of, say, 8 points, which is rather a tidy turn to make in a twelvemonth. Our belief is that even at 98, Consolidated gas is as good a thing to purchase as can be bought on the Exchange to-day. The queer management of the Standard Gas Light Company still causes much comment. Chief Engineer Egner, in order to maintain his self-respect, had to resign, and Manager Ludlam (so we are told) also enjoyed a very brief hour of office, in that his appointment was almost immediately followed by his undoing. Mr. Ludlam's leasehold of service in the Pleasant avenue menagerie was terminated some day this week. Of course, all these eccentricities have a "depressing effect" on the "common" stock.

Over in Brooklyn, old Brooklyn gas leads the list, 116 being bid for it. If intrinsic values count for anything (and in the long run they always do), old Brooklyn should sell for 135 when Williamsburgh is at 110. The advance in Brooklyn gas for the week is seven points. Chicago gas is again booming, having passed the 63 mark, ex-dividend. This is the highest that the stock has been for many months. The general situation is favorable to holders.

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* See Item Columns, p. 852.

A Rapid Method for Increasing the Yield of Gas from Ordinary Retort Settings.

[A paper read by Mr. R. Herring, of Dover, before the Southern District Association of Gas Engineers and Managers. Reprinted from the London *Journal*.]

Of late years numerous mechanical aids have been designed for cheapening the production of illuminating gas, but the majority of these are minus two important essentials—viz., reliability and simplicity. Some of the systems, also, necessitate such expensive structural alterations as to retard their general adoption. Therefore, if there is any economical and reliable method of improving results *without* structural alterations being made, more will be found willing to utilize it, in preference to the complicated and costly ones recently introduced.

With this end in view I have been working for nearly twelve months; and after numerous tests (experimentally and practically), I have ascertained that, with the addition of oil compressed and finely sprayed into the retorts (as will be described), more gas is produced than can be obtained from coal alone. In addition to this increase other advantages are derived, to which your attention will be directed presently.

Before entering into details or describing the apparatus, a few facts relating to my early experience with mixed charges of coal and oil will account for my later proceedings. About two years ago I commenced experimenting with these mixed charges; but I was at the time unacquainted with any method by which oils could be economically and succesfully used in the retort house, either as a mixed charge or as a substitute for cannel coal. The following facts will show how the subject was brought under my notice. When appointed to the management of the Dover gas works, I found a considerable quantity of crude naphtha in stock, which had been accumulating for years; and as tar was frequently boiled for asphalt, etc., the quantity increased. Being unable to sell it, I decided to use some in the retort house, and commenced as follows: Having procured a sound iron barrow, it was partially filled with small and dusty coal, to which naphtha was added until the whole mass was thoroughly saturated. This mixture was used in various ways for fixed periods; and from close personal observation I ascertained that when a small quantity was thrown to the middle of the retort just before the charge of coal went in it gave the best results, which far exceeded my expectations. After a few weeks working thus, the remaining naphtha was substituted for cannel coal. Afterward tar oil and various grades of paraffines were used in the same way as enrichers. This method was worked for about six months. The specific gravity of naphtha was .980.

During this time experiments with oils under pressure were carried on; and the improved results from this were at once apparent, convincing me that when this system was perfected it would be successful. Practical working has since proved this. The oils were compressed to a pressure of 25 to 30 pounds per square inch; and, by means of the injector, sprayed over the charge of coal or coke, with the retort lid shut. But before this could be tested in the retort house a suitable apparatus was required. Therefore, with as little delay as possible, a machine was constructed on the works, at the commencement of the present year, and is still working.

I now discontinued mixing oil with the coal, and proceeded as follows: (1) Ascertained the pressure that would be required to spray oil into the center of the settings. (2) Selected any retorts that had been working for five hours (previously charged with coal in the ordinary way). (3) Sprayed the oil over the hot coke, and continued at short intervals for six consecutive hours. Coal alone, 5 hours; coal and oil, 6 hours—total, 11 hours. The remaining hour is allowed to complete carbonization. The charge is then withdrawn, and the retort recharged with coal only.

Adopting this metnod, coal was continuously used for 18 hours, and oil 6. The number of retorts thus worked, and the quantity of oil used, depend entirely upon the enrichment required. Spraying compressed oil over the charges with the retort lid shut obtains much better results than when the oil is "mixed" with the coal and then put into the retort with either scoop or shovel.

With slight modifications, this system was regularly worked for about three months; but owing to the decreased production of coke, I was compelled to make further alterations, which resulted in the method now in use at the Dover gas works—viz., spraying compressed oil on a full charge of coal. The make of gas is increased and enriched, and the maximum quantity of coke is produced. This result is obtained thus: Select retorts, charged with the usual weight of coal in the ordinary way. Allow this to remain 2 hours, then spray compressed oil over it. Repeat this spraying at short intervals for 3½ hours. The remaining half hour, *no* oil to be used. At the end of the 6th hour withdraw the charge and repeat the operation. From this you will observe the 24 hours are made up as follows: Mixed charge of coal and oil, 14 hours; coal only, 8 hours; 2 hours to complete carbonization—half hour to each charge. *Example.*—In the retort house, each gallon of oil yields 85 to 90 cubic feet. I will now show how an increase of 5 per cent. in *quantity* is obtained on an estimated make of 10,500 cubic feet per ton. The oil required will be 6 gallons per ton of coal used, in equal proportions in each draw. This, at 87½ cubic feet per gallon, will produce 525 cubic feet, or 5 per cent. Should a rapid increase be required (say during the period of greatest consumption, etc.), supply more oil—5 to 7 gallons per hour can be safely dealt with.

We will now direct our attention to some of the advantages connected with this mode of working. Gas can be enriched more economically and rapidly than with cannel coal at its present price; and as this enriching can be carried on till within half an hour of shutting down, it is very useful at Sunday or other stoppages, as the necessary illuminating power can be maintained to the end. By spraying compressed oil over the charge with the retort lid shut, more gas can be produced than from coal alone, thus increasing the carbonizing power of ordinary retorts. The maximum quantity of best coke is produced. The make of gas can be instantly increased, thereby benefiting any who are compelled to work with limited storage.

The machine now working at Dover consists of a small reservoir, to which is attached a force pump. The delivery pipe is fitted with a pressure gauge, and communicating with a vessel in which the oil is compressed. To this is attached one or more flexible hose pipes, long enough to reach over one bed of retorts, and terminating in the sprayer. The whole is mounted on a light carriage. In addition to this apparatus, ordinary ¾-inch iron cocks are fitted to the retort lids, and in such a position as to admit of the oil passing clear over the charge, upon which it will fall in the form of a spray. If single retorts be used, the oil should strike the back; if throughs, it should just pass the center; and in no case ought it to fall nearer than 5 feet from the mouthpiece. With this machine 55 gallons of oil per hour can be sprayed; and this, working 9 hours per day, will produce about 43,000 cubic feet of gas.

From these details you will observe that the special appliances required for this process are few and inexpensive; and also that during 9 months' use I have found them reliable and easily worked. Up to the present time low pressure has been used—about 25 to 30 pounds per square inch; but in the future we shall use high compression, by which the expansion after passing the sprayer will be considerably increased, and the oil more thoroughly broken up. On no account should oil be forced into retorts in a solid stream, however fine—minute particles give the best results.

In this paper my experiences are very briefly stated respecting practical working with mixed charges of coal and oil, as compared with compressed oil, finely sprayed into the retorts, in addition to the usual quantity of coal, by which means an increased yield of gas is rapidly obtained from ordinary retort settings.

Discussion.

Mr. C. C. Carpenter said he was sure they were all much obliged to Mr. Herring for his paper. There were one or two points upon which it might have been clearer, and upon which he might have given them some information. Not having had a copy of the paper, he (Mr. Carpenter) was not sure whether the results had been obtained by the use of naphtha or some other oil; and he would like to know what was the kind employed. The other point, which was an all-important one, was this: How much gas did he make in the usual way with the ordinary coal; and what was the illuminating power of the gas? Then, what did he consider the proper quantity of oil to use; and what was the increase in the volume of the gas, and in its illuminating power? With regard to the rapidly-increasing yield from ordinary coal, it was not difficult to obtain that with any gas-heated furnace. With such a furnace, one could very quickly increase the make per ton by 10 per cent. Then, with the means of enriching gas now in vogue in London (he referred to Mr. Frank Clark's process, in which oil was used), they could very readily raise the illuminating power to the required standard. This was another and a simple way of obtaining results similar to those realized by Mr. Herring.

Mr. T. May asked whether Mr. Herring had worked out the cost per candle of enriching the gas by the process he had described. In a paper which Mr. Frank Livesey read before the Association last year upon the Clark system, he gave the cost of raising by 1 candle the illuminating power of any ordinary quality of gas; and if Mr. Herring could

give them similar information, it would answer Mr. Carpenter's question and his own.

Mr. A. F. Browne (Rotherhithe) said his experience with regard to the injection of oil into retorts had not been very great. He certainly had made some experiments in this direction. Whether it was that he did not try the process on a sufficiently large scale, or whether there was something radically wrong in the system he adopted in getting the oil into the retort, he did not know; but he could not say it was very successful. He injected a large amount of oil into the retorts. He increased the quantity put into each separate retort, and multiplied the number of retorts very considerably; but he was bound to say that, with regard to the increase in illuminating power, on the whole he was unable to get anything like a satisfactory result at all. At the Carshalton Gas Works, Mr. Good employed for enriching purposes Russian refined oil of .825 specific gravity. This was, of course, a cheap oil—much cheaper than the oil used in London, in Mr. Clark's process. It would be very advantageous if they could get the good results which were evidently to be obtained with this cheap oil—Mr. Herring obtained them, so did Mr. Good—but his (Mr. Browne's) experience with it was not a success. He next tried some experiments upon the direct carbonization of oil in separate retorts; and in this direction, he had certainly achieved much greater success. He might say that at the Rotherhithe Gas Works, the only difficulty was that the number of retorts was insufficient, in consideration of the heavy winter make of gas, to affect the whole bulk of gas to any extent. He was now using this system day by day. In the employment of the Russian refined oil, he thought they had a means of enriching gas which would compare favorably in point of cost with cannel, and also with Mr. Clark's process. The direct manufacture of oil gas, of course, took a certain amount of time; but the injection of the vaporized petroleum into the gas direct could be set in full operation in about five minutes. He could not agree that Mr. Clark's process was so cheap as had been stated. He did not wish to say at the present time what was the cost per candle; but he believed the cost of enriching gas 1 candle—from 16 to 17 candles—by oil gas direct as manufactured in the retorts, was about 2½d.; but occasionally he should say it would be more like 3d. He was still engaged on some experiments in this direction; but he had not yet had time to complete them. However he could certainly support Mr. Herring's contention that the manufacture of gas from this inexpensive oil was a cheap method of enriching gas.

Mr. J. Somerville said he had been trying oil in various ways, in place of cannel, for the past twelve months or thereabouts. The best arrangement he had employed was to drive the oil into the retort with superheated steam (at about 500°) two hours after the retort had been charged. This sent the oil into the middle of the retort; and he found this was by far the best method he had tried. He had not had any experience with Mr. Herring's plan of compressing the oil; but he thought it might answer. With regard to the question of cost, he found that, to raise the illuminating power of 1,000 cubic feet of gas by 1 candle, it cost from 1.12d. to 1.5d.—that was, using Russian oil of .850 specific gravity, at about 4d. per gallon delivered. At times the results obtained did not suit the gas-testing arrangements; and then they had to use a .680 spirit, and sometimes naphtha at .700, not in the same way, but by Clark's process. They did not use cannel at all; but they found that the Russian oil was all that was needed.

Mr. J. W. Helps (Croydon) observed that it was only fair to an absent member to say that the arrangement which had been described by Mr. Herring had been at work at Carshalton for some few years past; the only difference being that, instead of compressing the oil in a reservoir, and then conducting it to the retort, it was taken to the retort and compressed in a sort of syringe, and forced into the retort in the form of spray. He (Mr. Helps) made some tests two or three years ago, to see what amount of enrichment was put into the gas; but he was unable to get any particulars as to the exact quantity of oil then being employed, or as to the increase in the illuminating power of the gas. The quantity of oil that was being used increased the illuminating power by 1½ candles; and this seemed to be carried a considerable distance into the town.

Mr. J. Davis (Gravesend) asked whether Mr. Herring had any difficulty in converting the oil into a permanent gas.

Mr. F. D. Marshall (Copenhagen) said that a few years ago he tried a process of enriching gas which he patented in 1876 or 1877; but in that he used superheated steam. The oil was injected into the retort; but they experienced great difficulty, as they could not get it fixed. Afterwards they passed the gas from the lower retort through the mouthpiece into another retort; and they found, by that means, they were able to fix it. The process, however, was far too expensive. It cost them 16d. per 1,000 cubic feet, taking into consideration the amount of coke required for carbonizing the oil. He thought that to inject the oil into the retort was a mistake; and, in his opinion, it should be submitted to carbonization in separate apparatus. He had spoken on this subject to the Engineer of the gas works at St. Petersburg, where, as the members knew, oil was almost a drug. Even with low temperature there, the Engineer said he had no difficulty in fixing the gas. He told him that, in order to fix it, he carried it through a series of heated tubes; and he then injected the oil into the beginning of the condenser, and by that means he was able to maintain a fairly high illuminating power—in fact, as far as he could see, there was no deterioration whatever.

The President said it seemed to him that this matter had been put before them in two lights. They had conflicting statements in the discussion, which must have some meaning; and he would venture to give an explanation of the cause of it. In his experience of using oil as an enricher, he had arrived at this conclusion: That before they could do anything with it, in the first place they had to convert the oil into a permanent gas; and then a suitable conveyer had to be provided. If they were manufacturers of hydrogen pure and simple, without any illuminating power whatever, and they brought it into contact with gas derived by any means from oil, they would have no difficulty in having more than a mechanical mixture. Then the gas would prove permanent and stable; but if they used oil in the way described by the author—carbonizing it in ordinary retorts and mixing it with illuminating gas—then the difficulty they experienced was to find a proper conveyer or receptacle for those hydrocarbons which they wanted to keep with the ordinary gas. To carburet 15 or 16-candle gas was a very different thing to carbureting 13 or 14-candle gas; and before they could develop the full use of oil, he was convinced that they must make a gas of the old type—say 14-candle gas—and then carburet it. With regard to the system described by Mr. Herring, he must join with those whose experience had been that it was not a suitable way of enriching gas. He had made some experiments with oils of various specific gravities, and used them in a retort; and he had succeeded—in fact he was determined to make its presence visible in the engine room; but when it passed through the other apparatus he could find no trace of it. He might also mention that he had recently proved that, if they wished to use oil of a specific gravity of .8, or something like that, in the most satisfactory manner, the only way they could do it was by carbureting water gas. In this manner they obtained from the oil exactly double the value that they would do when using it in an ordinary retort, and carbonizing it as they would coal.

Mr. Herring, in reply, said, with reference to Mr. Carpenter's questions, that the oil he used had a specific gravity of .825, and was not rectified. The illuminating power of the gas was increased 1½ candles—from 14½ candles to 15¾. Mr. Browne stated that he did not get good results by injecting oil into his retorts, and that he injected increased quantities. That was where, in his opinion, Mr. Browne did wrong. It was necessary to use the oil in very small quantities indeed—in fact they could not put into the retort too little at one time. Besides, the oil must be compressed, otherwise it would not be broken up.

The President—You compress the oil before it is put into the retort, and you attach importance to that?

Mr. Herring replied that he did. Mr. Davis had asked him whether the gas was permanent. He could only refer him to last winter, when the temperature, he thought, was equal to that of Copenhagen or St. Petersburg; and the gas then remained permanent. Facts went to show that this process effected a considerable saving, owing to the decreased quantity of cannel used, and the increased amount of coke produced. Mr. Good did not compress his oil; he simply put it into the mouthpiece of the retort, where it should not go. If the retorts were single ones, the oil should be sent into the back ends; but if they were through retorts, it should fall in the center. Then in its passage to the ascension pipe it would become fixed and made into a gas.

Mr. May asked what it cost to increase the illuminating power of the gas by 1½ candles.

Mr. Herring said he could hardly answer that question; but he could give the members a few interesting figures. He would take a period of four months' working in the years 1888 and 1889 when cannel was used, and the same period of 1891, when oil was employed. In 1888 it cost £136 to enrich the gas from 3,337 tons of coal; in 1889, £182, with 3,957 tons; and in 1891, £84, with 3,954 tons. During these periods the working conditions and the coal were practically the same; and the illuminating power was raised 1½ candles. If they could enrich gas by any other means than cannel, the value of the coke was at once increased. In his own case, nothing but best caking coal was used; and the best coke was produced. All the retorts were charged with the maximum quantity of coal, and were doing their full work, plus the gas produced from the oil.

A vote of thanks was passed to Mr. Herring for his paper.

Alternating Electric Systems and their Physical Hazards.

[A paper read by Mr. George P. Low before the Fire Underwriter's Association of the Pacific Coast.]

In entering upon a discussion of alternating electric currents and their hazards it is meet that their purpose should be explained. Why is it that the alternating system, with its extremely high voltages, fatal to life and possessing hazards to property peculiar to itself, should be used for purposes of interior illumination when the ordinary incandescent systems furnish equally good service, are incapable of inflicting even temporary injury to human beings, and are without certain hazards possessed only by the alternating system? At a first thought it may appear to the laymen that alternating systems have no legitimate excuse for their existence, and that their use by electric lighting companies instead of the ordinary low potential systems exposes the public to unnecessary hazards. So far as the property or fire hazard is concerned, such an idea is entirely wrong, for, as will be shown, honors are about evenly divided between the hazards of the two systems. If the alternating system has a hazard that the low potential system does not possess, the latter also has a hazard peculiar to itself, and from which the use of alternating apparatus is exempt, but whichever system is used the attending hazard may be reduced to an iota, if not eliminated, by devoting proper care to every detail of installation. I do not consider the hazard of a poorly constructed installation to be greater than that attending the use of oil as an illuminant, and I do consider that, next to the sun, a properly constructed incandescent system is the most perfect system of illumination, either natural or artifical. As has been previously stated, to obtain light heat must be generated; and no matter in what is its condition the energy capable of creating a light-giving temperature direct may prove incendiary. Even the light and attendant heat of the sun has caused fires. Strictly speaking, therefore, there is no such thing as an absolutely safe illuminant unless it be the light of the moon or stars, which would hardly satisfy the exactions of our civilization. All methods of producing light artificially have elements of danger. Some of their hazards are great and some are only moderate, yet in electricity is found a light-producing energy that can be used with the least danger of all—and it is quite immaterial whether this opinion be applied to the light produced by the low potential or "direct" system, or from alternating circuits. The only requisite is that the circuits and apparatus be properly installed.

In the electrical exhibition at Frankfort, Germany, are incandescent lights and pumping machinery operated by dynamos driven by water power at Lauffen, 110 miles away. Although 300 horse power is transmitted that distance, yet three copper wires, each less than one-eighth of an inch in diameter, are sufficient to carry the energy consumed. The cost of installation is such that it could be undertaken by any electric lighting company of any large city, yet to obtain equal results under the same conditions by the low potential system would necessitate investments that would appall any capitalist, syndicate or government. The solution of the problem of long distance incandescent lighting is due, therefore, to alternating systems alone.

But let us turn to the nature, characteristics, and phenomena of alternating currents, and in so doing we will study an application of electricity which presents most interesting features and becomes more and more wonderful as the research is pursued. Continuous currents have characteristics rendering them indispensable for some applications, such as in electro-plating or in installations where storage batteries are used. Moreover, in the present state of the art electric power derived from continuous current circuits, either from constant potential or from constant current systems, is far more satisfactory and efficient than electric power derived from an alternating current. Indeed, alternating currents can never entirely displace the use of continuous currents in some branches of applied electricity; yet it requires no great foresight to reach the conviction that the energy of distant water powers can best be brought into the centers of population and industry by means of electricity in a state of ceaseless alternations. In the system then rests the idea that is not revolutionizing, but which is developing electricity into a more indispensable factor of civilization. It is singular that this, the latest development in the new science, is but the perfection of the first form of dynamo electric machinery that was devised. Then, way back a generation or more ago, the few dynamos, or, more properly speaking, the few magneto-generators used, produced alternating currents, but its peculiar differences from the then familiar galvanic electricity led to the invention of the commutator, by means of which alternating currents were commutated or rectified into continuous currents. Alternating dynamos are the simplest electric machines in existence. They consist merely of a coil of wire passing first in front of the positive pole of a magnet, then in front of the negative pole, then by a positive pole, and so on. As the coil passes one magnetic pole, a positive potential is generated, then, as it passes the opposite magnetic pole, an electric potential of contrary sign or a negative potential is generated, and so it goes on, alternating first positive, then negative, then positive, and so on, the number of these changes effected in a given time being the number of alternations of the dynamo. In the modern alternators these potential changes occur at a rate from 500 per second up, and as previously stated, the almost inconceivable rate of 20,000 complete alternations per second has been attained in an experimental dynamo. Inasmuch as the mission of the commutator in dynamos is to rectify currents, or to straighten them out, so that they shall flow in one direction, it must be plain that there is no need for such a device in the alternator. The armature consists virtually of but one coil of wire, each end of which is connected to a separate ring or collector, placed upon the armature shaft, and from which the current is taken by brushes. The field magnets of alternators are of peculiar form, and in most machines they consist of a massive circular or cylindrical iron frame, with pole pieces extending inward radially. About these pole pieces are coils of wire, through which is driven current, generated by a little independent continuous current dynamo, called the exciter, from the fact that its current excites or energizes the fields of the alternator. The necessity of this little dynamo will be recognized when it is understood that it is impossible to magnetize a bar of iron to a fixed magnetic polarity by means of an alternating current, as the magnetic pole changes synchronously with the alternations or directions of current flow. It is essential that the magnetic poles of the fields should alternate, the first field being positive, the next negative, and so on, and to do this a continuous current must be used, the current being carried around the iron core in one direction to produce a positive pole, and in the reverse direction to produce a negative pole. The armature coils in passing these alternating poles, generate the alternating current under consideration.

We now come to the vital feature of the system, namely the converter or transformer, the study of which forms a succession of wonderfully interesting surprises, each more agreeable than its predecessor. Allusion has already been made to the belief that electricity and magnetism are but different manifestations of the same energy, and you all understand how readily interchangeable they are. Every wire carrying an electric current is surrounded by a field or atmosphere of magnetism which permeates the surrounding element in a whirling direction, no matter whether that element be air, the hand, glass, wood, metal or any other substance. In fact, there is no such thing as an insulator of magnetism known. We can insulate conductors carrying electricity very effectually, but magnetic lines of force permeate glass, or a block of brass with about the same facilities as they would traverse an equal distance through air. Perhaps coming generations will invent or discover an insulation that will be impervious to magnetism, but it is something we have not yet reached. As stated, these lines of magnetic force emanate from wires carrying currents as well as from the poles of magnets. If the current flows in one direction the resultant lines of magnetism will have a given magnetic polarity or whirl, while if the direction of current flow be reversed, the magnetic whirls about the conductor will also reverse, and their magnetic polarity will consequently be changed. It follows then that when an alternating current traverses a conductor the direction and polarity of the magnetic lines or whirls of force about it are changing with equal rapidity.

Again, suppose two wires are run along side by side for any distance, and that an alternating current is traversing one of them. In this event a secondary and entirely independent electrical potential will be created in the second conductor. No metallic connection exists between these wires, hence there can be no actual transfer of electricity from one to the other, but the phenomenon that does occur and which occasions a potential in the second wire constitutes induction. To more fully illustrate this, let us consider another experiment. Wrap a few hundred feet of wire into a flat coil and place it upon a table, covering the coil with a sheet of thick plate glass. On this glass, immediately over the first coil, place a second similar coil, connecting its terminals to an incandescent lamp, and on sending alternating current through the first coil, the lamp will burn from the current generated in the second coil by induction. If iron is brought into proximity of the two coils the inductive action is increased, owing to the fact that iron affords a path of lower resistance for the magnetic lines to travel through, and that consequently a greater number of these lines or a greater magnetic intensity exists.

The earliest development of these phenomena appeared in the induction coil, consisting of a bundle of fine iron wires forming a core,

about which was wound a comparatively few turns of insulated thick copper wire, called the primary. This arrangement thus far will be readily recognized as an electro-magnet. Around the outside of this electro-magnet is placed an insulating wrapping of paper or gutta-percha, then over all is coiled a great many turns of insulated fine wire, called the secondary coil. It will be noted that no electric connection exists between the two coils—in fact, the higher the insulation between them the better. Such is the construction of the induction coil; and now for its method of operation. Those who were present at the reading of the first paper of this series will remember that in speaking of the interchangeability of electricity and magnetism reference was made to the electro-magnet, and it was shown how the iron was made magnetic by the circulation of a current of electricity through the coils surrounding it, and how an electric current would flow through the surrounding coils as the iron core became magnetized or demagnetized by some external means. Upon this fact rests the vital principle of the induction coil, and of its perfected form, the converter. In these the mission of the primary wire is to magnetize and demagnetize the core in order that the magnetic rays emanating from the core whirl through the secondary coil, first in a given polar direction, then in the opposite one, and by so doing induce a current of electricity in the secondary coil. Converters, then, like dynamos, become generators of electricity, and to go into the subject a little deeper let us see just wherein they differ. Dynamos, as you are aware, consist essentially of an armature revolving between electro-magnet pole pieces, across which pass lines of magnetism of a fixed intensity. The wire on the revolving armature passes through or cuts this fixed magnetism, the potential of the armature wire is disturbed, and an electric current is generated. Now, for the converter. In it there is no moving or revolving armature wire. Instead of the wire cutting lines of magnetism as in the dynamo, the ever-varying lines of magnetism from the iron converter core dart out and whirl through the wires of the secondary coil, and current is generated precisely as in the dynamo armature. In the dynamo the wire cuts the magnetism; in the converter the magnetism cuts the wire, and the result is the same.

Again, it is necessary to revert to our first paper, and impress the statement then made that electric energy does not depend alone upon volts, nor upon amperes, but upon their product, which gives us the unit of electric energy called the watt. The magnetic energy imparted to an iron core is, however, dependent upon the number of amperes traversing the surrounding coil, multiplied by the number of turns of wire in the coil, or, technically speaking, upon the ampere turns. Thus 10 amperes flowing about an iron core through 100 turns of wire gives 1,000 ampere turns, and the resultant magnetism will be the equivalent of that produced by ½ an ampere flowing around through 2,000 turns of wire. Again it consumes a fixed amperage and a fixed voltage, consequently a known wattage or energy to affect the ampere turns in the primary coil necessary to magnetize the core of a converter, and if the efficiency of the apparatus is perfect, the energy of the magnetism will be reconverted into electrical energy in the secondary coil, equal in value to that expended in the primary. If, therefore, ½ an ampere at 2,000 volts goes into the primary, an equal energy, such as 40 amperes at 50 volts, may be drawn from the secondary. It is now apparent, I hope, that alternating systems owe their ability to operate over long distances, and with small conductors to the fact that the electric energy driven from their stations to the point of consumption consists of small amperages (necessitating but small conductors) and high voltage. Then the converter transforms this energy into a nearly equal value, but of low voltage, and of correspondingly increased amperage.

There is another interesting feature in converters which is a very important factor in the economical operation of alternating systems. It is the phenomenon or fact, whichever you like, called counter electromotive force. To illustrate. A constant potential dynamo and a motor are in reality one and the same machine. Apply power to it and electricity is produced, or apply electricity to it and power is produced, either or both resulting from the rotation of the armature within a magnetic field. When the machine is running as a motor then the conditions are virtually the same as when it is being driven as a dynamo, for the armature is being revolved between magnetic fields as is a dynamo, and a current or electrical potential must therefore be generated within it. This potential, however, is in polarity opposing or counter to that of the source of electricity which drives the machine as a motor, which leads to the calling the opposing potential "counter electromotive force." A constant potential motor in running without load generates a counter electromotive force nearly equal to the voltage of the supply current, and as a result of this nearly balanced counter electric pressure, but very little current will go into the motor. If, however, a load be thrown upon the motor checking its speed, the counter electromotive force is lowered as the speed slackens, the counter pressure being relieved to a certain extent and the motor takes more current. Throw off the load, and the armature speed increases, the counter electromotive force raises, and again the motor takes but little current. Such motors are, therefore, self regulating—that is, they take current or ampereage almost in direct proportion to the work they perform, hence their economy in operation is great.

If a clear understanding of this is had it will not be difficult to fathom the almost identical action that takes place in the converter. There an impulse of current circulates in the primary coil, magnetizing the core, which in turn induces a current in the secondary coil, and this secondary current is of a polarity opposite to the succeeding alternation of current which energizes the core. Inasmuch as the primary coil surrounds the core just as the secondary one does, it is plain that an electric pressure must also be induced in the primary coil synchronously with and in the same direction as that induced in the secondary coil. This is precisely what does occur, and here we have the counter electromotive force in converters. While no current is drawn from the secondary the polarity of the counter electromotive force in the primary nearly opposes the polarity of the succeeding alternating impulse that magnetizes the core, hence but little or practically no current passes into the primary, but when the current is drawn from the secondary the magnetism of the core, having work to do, does not respond to the rapid alternation so promptly, or, technically speaking, "lags," which results in a tardy counter electromotive force, and consequently greater consumption of current in the primary. Converters, then, like motors, consume current in close proportion to the work they perform.

With the exception of the transformation of electric energy from high to low potentials through the converter, the methods of operating alternating systems are the same, as practiced in constant potential systems. The current taken from the secondary coils of the transformer is distributed throughout the premises to be lighted just as in the ordinary incandescent system, yet the hazards of the systems are not identical in every detail. Crossed circuits or contact with bell wires, or with gas pipes, are as dangerous in one system as in the other. With alternating circuits, however, little or nothing is to be feared from the disastrous electrolytic action, or, more properly speaking, from the electro deposition that invariably occurs when any form of moisture forms an electrical connection between any two continuous current conductors of opposite polarity. As has been previously explained, the wearing away of one conductor by electrolytic action is a most prolific source of trouble. Why this hazard cannot exist in alternating work will be plain when it is remembered that to deposit metal the current must flow in one direction only; hence, with an alternating current the metal deposited from a positive impulse will be sent back to the anodal wire by the succeeding negative impulse and so on. No real deposition will, therefore, occur, though electrolysis proper, or the liberation of gases, is possible.

To offset this hazard, which is inherent only in the use of poorly constructed continuous current systems, the alternating system has a hazard distinctively its own. No matter what the make, converters will some time burn out, either from improper insulation, careless handling, or overload, and when a converter burns out, fire may be caused by any one of several causes. First, the high potential primary current may get over into the secondary coils and be distributed thence over the interior wiring designed to carry not a pressure of 1,000 or 2,000 volts, but 50 or 100 volts. The hazard of such an occurrence is apparent. Some forms of converters are saturated with inflammable compounds used to effect insulation. If such a converter burns out the insulating compounds will sometimes melt and run down like boiling tar over whatever is beneath, and boiling tar and electrical fireworks would make a combination not at all agreeable to the fire underwriter. All that is apparent in nine out of ten converter burnouts is simply a lively humming and the appearance of considerable smoke. Converters are invariably placed in iron cases and fire within them could do no external damage other than that due to smoke; indeed, in some localities the placing of converters in insured buildings is prohibited, principally for the reason that should they burn out the presence of so much smoke might lead to the calling out of the fire department and a consequent water damage, but this is an idea in which I cannot concur. These are the differences in the hazards of the two systems, and comparative consideration of them both leads to the belief that despite the hue and cry about high voltages, one system is just about the same as the other.

The public is frequently told by those who should, if they do not,

know better, that an alternating current cannot maintain an arc, and that the system is consequently free from one of the hazards of the continuous current circuits. If this statement is true, how is it that arc lamps are burned on alternating curcuits? It is certain, however, that accidental alternating arcs are very uncertain in their action. Sometimes they will draw out nearly as long as continuous current arcs of equal voltage; then the next instant the arc may almost refuse to form; in fact, it acts as though the arc depended for its length upon the position or phase of alternation at the exact instant of break in the arc producing contact.

An analysis of an alternating impulse shows that it begins at a zero pressure and rises to the full potential of the machine, say 2,000 volts; then the potential falls gradually back to zero again, whence it continues falling to a potential of 2,000 volts below zero, we might say, from which point it rises to zero and continues another cycle. In a 2,000 volt alternating current there is, therefore, a maximum variation of 4,000 volts between the highest potential and the lowest potential and there is, moreover, two points in each alternation at which the potential is nil, or zero. These points may occur within less than the one one-thousandth part of a second, yet that is a material space of time when reckoned by electricity. As stated, arcs drawn from breaks in alternating circuits are so erratic in their action that they appear to depend upon the phase or condition of the current at the exact moment of break.

Sometimes long arcs may be drawn out, possibly because the cycle at the instant of break is at a maximum potential; sometimes, though seldom, little or almost no arc at all will be drawn, possibly for the reason that the current was broken at the exact moment when it was at a zero potential. These are things that cannot be predetermined, yet, everything considered, it is true that alternating arcs are not as formidable or as vicious as those drawn out from continuous currents of equally high voltages.

The remarkable flexibility of electric energy, when converted from one form to another by means of the alternating current transformer, has led to the achievement of numerous results hitherto considered impracticable if not impossible. The perfection of the art of electric welding is due to alternating currents, as are also certain forms of electric heaters and some new and novel electric motors especially adopted to transmitting power over long distances. In fact, it is believed by many that the greatest advances made in electricity during the coming decade will be in the direction of alternating systems. As the use of these, like all other applications of electricity, is becoming more and more familiar to the public, the belief is slowly but surely, though perhaps unconsciously, being accepted that the hazards attending the use of all forms of properly installed methods of electric lighting or power are greatly exaggerated. In the present state of the science, where a rigid enforcement of insurance or municipal requirements, supplemented by vigorous inspection, results in the observance of safety laws, it may be truly said, even by the most conservative, the fire hazard of electric lighting is more imaginary than otherwise. The tendency of the period in electrical development is toward the use of alternating currents at higher and higher potentials, yet the safety devices designed to control these excessive voltages prove absolute in their offices, so, that it is safe to predict that neither the fire underwriters nor the public will find a materially increased hazard in their use.

Comparative Photometric Tests of Large Gas Burners and Lanterns for Public Lighting.*

[Translated for the JOURNAL, by Mr. C. S. Davis, from the *Journal des Usines a Gaz.*]

In addressing you on this subject, I must recall to your minds the fact that it is a subject which has been many times discussed, and very ably so. But I thought it might prove instructive and interesting, in view of the photometric tests made by Inspector Ries and myself last year, and about which Director Diehl then told you, on the one hand, to complete those tests as far as might be necessary for an exact comparison of the more important regenerative lamps on a basis of separate tests, and a certain number of street lamps; and, on the other, to experimentally verify the method itself of testing.

There is often very little difference between the luminous powers of several styles of lamps. Hence it seemed fitting to make the method of testing so exact that the parallel tests made with one and the same lamp should show only the least possible differences.

I may take for granted that the manner of testing by means of the Elster angular photometer, which we have employed, is well understood.

In photometric tests of luminous sources of considerable intensity, an intermediate or comparative source of light is always necessary, for reference to the standard on the one side and to the luminous source to be measured on the other. This double measure entails the liability of double error in reading, as is well known. The errors in reading made in measuring the lamp with the standard burner easily amount, even when the test is made with the greatest care, to 4 per cent.; that is to say, to 0.04 of error for a reading of 1.00. In regulating the standard burner to a luminous unit, the mistakes made may, without exaggeration, be estimated at 2 per cent. Then, again, by taking account of the errors made in reading the gas meters, occasioned by the variations in the light unit employed, etc., there may be readily committed, for one single lamp, a total error of 6 per cent., which, for a lamp having a lighting power of 70 candles, would be equal to 4.2 candles. But in reality far more important mistakes are frequently made in parallel tests, for the lamps themselves are subject to grave variations, whereas the hypothesis is always made that the gas, on its part, has a luminous intensity absolutely constant. But as this is never the case, it has been proposed to employ as a unit, to which the standard burner may be referred, not alone the light unit itself, but the normal Elster Argand burner, fed with the very same gas as the lamp to be tested. For it is freely admitted that a variation in the lighting power of gas does not change the ratio existing between the lamp and the normal Argand burner.

It has seemed best to us to experimentally limit this hypothesis.

We have mixed with the gas different fixed quantities of air in order to lower the quality, and then fed each of these mixtures in one case to a regenerative lamp and another time to a slit-burner lamp. The following table gives the photometric results obtained:

Air Added in 100 Parts of of Gas.	Luminosity of the Slit-Burner Lamp.		Luminosity of the Regenerative Lamp.	
	In Heffner Light Units.	In 100 Parts of Luminosity for an Addition of—	In Heffner Light Units.	In 100 Parts of Luminosity for an Addition of—
0	18.37	100.0	70.06	100 0
2	16.22	85.5	58.35	83.3
4	13.88	73.2	51.96	74.2
6	11.85	62.4	45.29	64.7
8	9.82	51.8	36.57	52.2

We find from this table that the diminution in percentage of the two burners, in proportion to the increasing quantity of the air intermixed, is almost the same. The mistakes are in the limits of the errors of observation.

The conditions under which another test was conducted are different.

A regenerative lamp was measured by means of the Elster angular photometer with an Argand burner as the standard of comparison. Furthermore, the same gas which supplied both burners was mixed with air, but always in exact quantities. Designating the lamp by L, and by a the standard burner, the ratio $\frac{L}{a}$ for the mixtures of air below has been:

0.0 per cent	20.9
2.3 "	20.5
3.1 "	20.5
6.8 "	26.0
12.9 "	30.7

It follows from these figures that the two lamps were in a fixed ratio to each other until the air supply had exceeded 3.1 per cent. As may be foreseen, an even greater addition of air would not affect the ratio if it were not that the flame of the standard burner, whose consumption was only 1.90709 cubic feet, in consequence of the increase of air, burned with such feeble power that combustion could not take place under constant normal conditions.

For the limits within which gas ordinarily varies, we may consider the exactness of our hypothesis as proven, by virtue of which all burners vary proportionally; that is to say, the ratios of the slit burner, the Argand burner and the regenerative burner remain constant so long as these appliances are fed with the same gas.

The figures below show that the luminous intensity of an Argand burner, burning with a very small flame, diminishes very much more rapidly in case of an important fault in the consumption than when this intensity is calculated proportionately to the diminution of consumption.

* A paper read by Dr. N. H. Schilling before the German Association of Gas Engineers.

The standard Elster burner has given for a consumption of

1.91769	cubic feet	2.22 candles.
1.61396	" "	1.32 "
1.31377	" "	0.54 "

instead of which the calculation in proportion to the diminution of consumption gives for the consumption of

1.91769	cubic feet	2.22 candles.
1.61396	" "	1.87 "
1.31377	" "	1.52 "

This surely tends to prove that for such small flames, the chilling produced by the diffusion of air in combustion is very considerable, with the result that a normal development of constant light is no longer obtained.

A series of photometric observations has been made of such a kind that both before and after each test of the lamp at the various angles, the standard burner has been regulated by the normal Argand burner, fed with the same gas. But it has even then, naturally enough, produced differences such that the standard burner gave higher values before than after the test. It was not shown that this variation was occasioned by the vitiation of the air and by the rising of the temperature in the chamber of the photometer, but this supposition has been confirmed by a test carried on for a period of two hours with the chamber of the photometer completely closed. The following table gives the results obtained :

Hours.	Ratio between the Normal Argand Burner and the Standard Burner.	Temperature of the Photometric Chamber.
4 h., 00 m.	Moment of lighting	15.6°
4 h., 35 m.	7.071	17.0°
5 h., 15 m.	7.127	19.0°
6 h., 00 m.	7.371	19.0°
6 h., 10 m.	7.525	19.5°

When it was a matter of comparing different lamps with each other, in the first place in regard to the relative luminous intensity existing between them, and, in a less degree, in regard to their absolute luminous intensity, we have modified the method of test as follows : Neglecting to regulate every time the standard burner by the normal Argand burner, we have taken the former as unity and referred the other lamps to that alone. It was adjusted once precisely and exactly by means of the Hefner-Alteneck lamp, and has given an absolutely constant light with uniform consumption. This consumption has been fixed at 1.90709 cu. ft. for all the experiments and kept fixed during the continuance of the tests.

Experience has taught that it is of value for this purpose not to use regulators, for they are not perfectly reliable and exact. The consumption has been adjusted as accurately as possible by hand with a micrometric screw and tested every minute, and in the calculation account has been taken of slight errors, on an average about 54.

In order to refer all the tests to a gas of fixed luminous intensity, we have adopted, as normal gas, that which, at a rate of consumption of 3.53165 cu. ft. in a slit burner should have a luminous intensity of ten (10) Hefner-Alteneck lamps. However arbitrary this hypothesis may be, we may freely modify, to suit any other kind of gas, the results actually obtained with this gas, which should be regarded as normal.

The different principles applied in each city in testing gas are, perhaps, the fertile causes, by reason of which the photometric tests made with large gas burners and with different gases so often present such important variations.

It is, then, highly to be recommended that all tests intended to determine the value of certain lamps, as in the actual case, be referred to a "normal gas" precisely defined. It is for this purpose that we have retested in these trials those lamps previously examined, and which we have classified one by one.

The luminosity obtained, in referring it to this normal gas, for the standard burner by several tests, with a very considerable degree of agreement, has been :

1st test.	3.42	after 10	readings.
2d "	3.45	" 20	"
3d "	3.41	" 10	"
4th "	3.45	" 10	"
5th "	3.39	" 10	"
Average.	3.42	Hefner-Alteneck light units.	

By this method errors have been, as far as possible, obviated, and several parallel tests have been rapidly made one after another. The trials, always conducted by two experimenters, have been made with every requisite precaution and care. I ought specially to mention that only those lamps having an approximately same consumption of 10.59495 cubic feet have been compared.

The lamps that have been tested are :

I.—*Regenerative Lamps.*

The Wenham lamp.
The Bandsept lamp.
The Stern lamp.
Siemens's reversible lamp.
The Westphalia lamp.
The Sylvia lamp.
The Siemens's flat burner.

II.—*Street Lanterns.*

The Munich lamp, with simple slit burner.
A lamp with two adjoining slit burners.
Lamp with Zwillings' burner.
Krause's large burner lamp.
The Munich large burner lamp.
Schulke's large burner lamp.

(To be continued.)

Snow's Gas Retort Furnace.

On October 27, U. S. Letters Patent No. 462,021 were granted to Mr. William H. Snow, of Holyoke (subsequently Mr. Snow assigned his interest to Mr. Charles S. Waldo, of Boston), for improvements in gas retort furnaces. Using the words of the specification, we find the inventor saying :

The object of my invention is to produce in as simple a manner as possible a furnace in which there shall be substantially perfect combustion, owing to the supplies of heated air furnished both below the grate and in the combustion chamber below the retorts.

In the drawings are shown sectional views of a furnace embodying my invention.

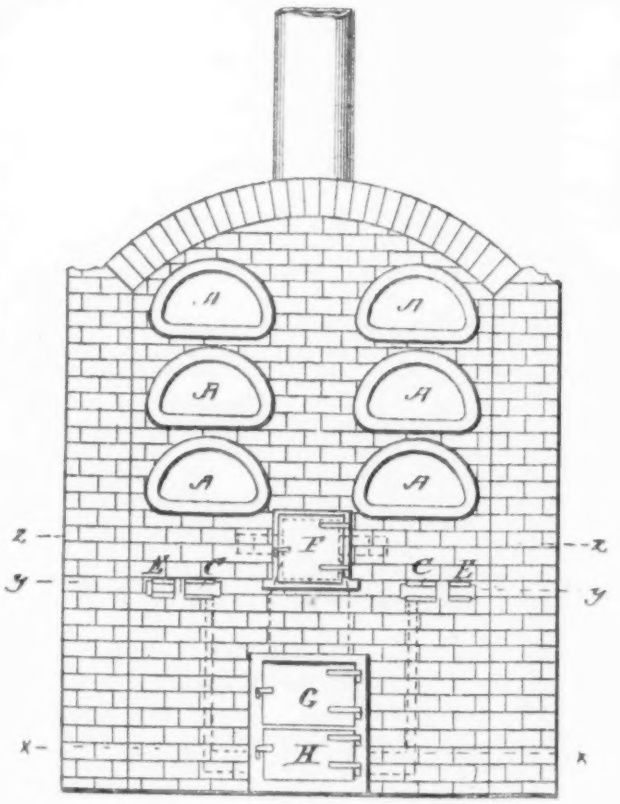


Fig. 1.

Fig. 1 is a front elevation of such a furnace, various parts being shown in dotted lines ; Fig. 2 is a horizontal section on line *x x* of Fig. 1 ; Fig. 3, a horizontal section on line *y y* of Fig. 1 ; Fig. 4, a horizontal section on line *z z* of Fig. 1 ; Fig. 5 is a sectional view, in elevation, on line *w w* of Fig. 3 ; and Fig. 6 is a sectional view on line *v v* of Fig. 4.

The retorts are shown at *A*, and may be supported within the combustion chamber in any of the well known ways.

B is the fire box, also of ordinary construction, except as below described.

I supply air to the grate by means of flues *C*. These flues open in

front of the furnace, as shown in Fig. 1, just below the normal level of the fire, and pass down through the brickwork at the sides of the fire box to a point below the level of the grate bars. Here they are connected with the ashpit *D* by means of small ports *c*, which serve to spread the air over practically the entire surface of the ashpit, thus supplying the air for combustion in the firebox over the entire lower surface of the

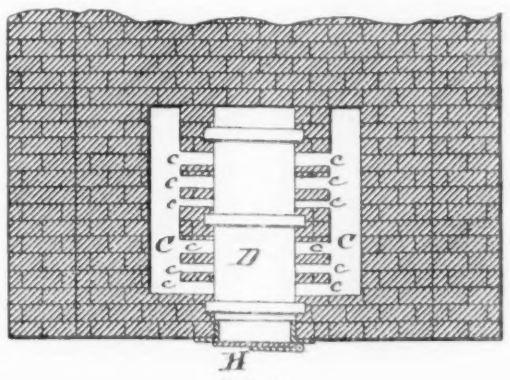


Fig. 2.

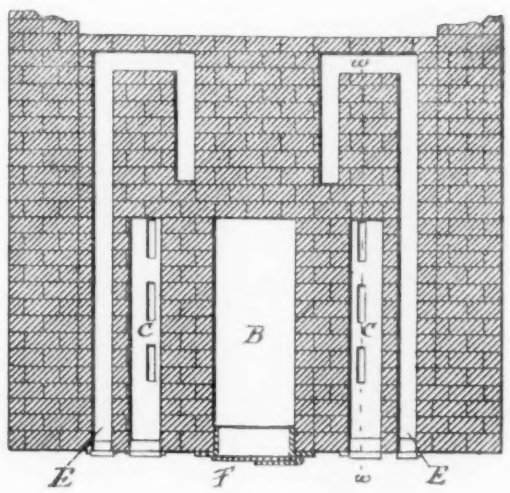


Fig. 3.

fire box and causing a substantially equal distribution of air for the purpose.

I supply air to the combustion chamber just above the normal level of the fire by means of flues *E*, which open in the front of the furnace and pass back, as shown in Figs. 2 and 3, through the brickwork which forms the sides of the fire box, and then up onto a level with what is normally the top of the fire. Here this flue lies horizontal on both sides of the fire, and is connected with the combustion chamber at its lowest point by means of ports *e*, these ports being located opposite each other, so that the air is distributed evenly over the surface of the fire. It is evident that during this passage through the walls of the furnace the air in both flues is heated, according to the temperature of the brickwork, and is supplied to the fire at a very high temperature.

It has been found by experience that a furnace constructed as above described requires less fuel to accomplish a given amount of work, because of the more perfect combustion which the supplies of air above described afford. Consequently it requires less labor to tend, and with a given amount of fuel it produces a larger quantity of product.

By supplying the flue openings in front of the furnace with sliding doors the amount of air to be taken into the furnace can be easily controlled.

In feeding the furnace, fuel is supplied at the firing door *F*, *G* being the clinkering door and *H* being the ashpan door, these parts being made in any customary way.

The main advantage of my furnace is due to its perfect simplicity. The air is heated sufficiently hot by passing through flues separated by a comparatively thin wall from the fire box, and from these flues it passes either to the chamber below the grate or to the combustion chamber. The flues being located as shown, the air is sufficiently heated without requiring the use of smoke flues to convey the products of combustion about through the walls of the furnace, as has been done heretofore. In this latter case there is always a great chance for leakage, especially after the furnace has been in use for some time, and also a chance that the smoke flues will be stopped up more or less with soot and other impurities, so that from time to time they will have to be cleaned out, which, as those skilled in the art know, is a tedious and expensive process, requiring the furnace to be cooled off thoroughly and practically to be pulled to pieces and rebuilt. In my furnace there is no such danger, as will be readily understood, as there are no such smoke flues. My retort chamber is a direct passage for the products of combustion from the fire box to the chimney, and being entirely closed except where it is connected to the fire box and chimney the products of combustion, while they are required to circulate around the retorts in the customary way, will pass directly from the fire box through the retort chamber to the chimney. I am aware of the existence of prior furnaces in which the retort chamber is not directly connected with the chimney and the products of combustion are required not only to pass around the retorts, but also before reaching the chimney to pass through various small flues built in the side walls of the furnace, which offer

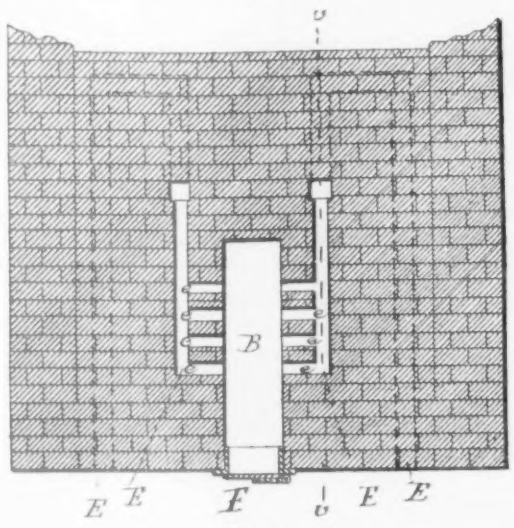


Fig. 4.

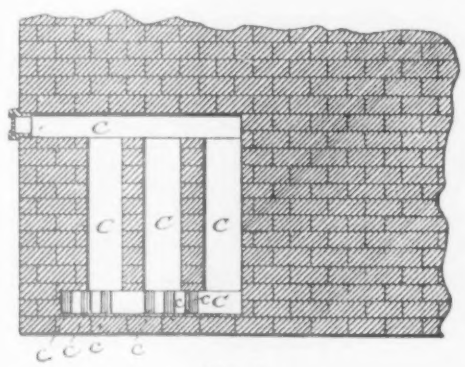


Fig. 5.

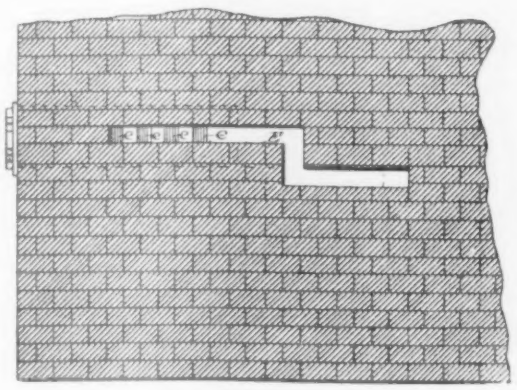


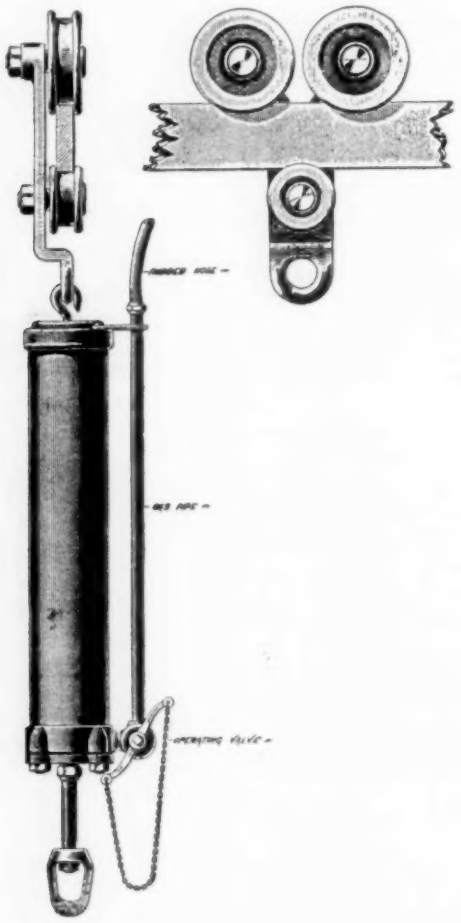
Fig. 6.

great resistance to the natural draft. Such furnaces differ essentially from mine. The addition of such arrangements to a furnace results almost of necessity in the addition, also, of artificial means by which to establish and maintain a sufficient draft to keep up proper combustion, while the addition of my air passages to a furnace produces no material effect on the draft.

Frederick & Ayer's Pneumatic Hoist.

The illustration shows a pneumatic hoist intended to take the place of the ordinary chain hoist or block and fall for lifting comparatively light loads about machine tools, in shops and similar places. It is, in effect, a simple power hoist, which can be quickly started and stopped by the manipulation of a small valve.

The construction is well shown in the engraving. The cylinder is small, of extra strong wrought iron pipe, carefully reamed out; to the upper head is fastened an ordinary pipe cap, to which there is attached a hook, by which the hoists can readily be hung to the overhead trolley, and, if desired, the hoist can be transferred to different parts of the shop. The lower head is made of two castings, one of which is screwed to the end of the cylinder, and has a lug to receive a screw end of the valve, which supplies the air for lifting. This prevents the piston from traveling below the air opening. To this lower ring is attached a head which is held in place by four small studs and nuts; this head also contains the stuffing box for packing around the piston rod; by this construction the lower head can be readily removed for an examination of the piston and its packing without in any way disturbing the hoist. The



piston is of simple design, consisting of a cast iron head, follower plate and a leather cup-ring, which nicely adjusts itself to the cylinder and prevents leakage. The lower end of the piston rod has a swivel which allows the ring to be turned to any desired position in the rod. The piston acts but one way, as it has been found that the weight of the load, or even of the piston rod and head, is sufficient to allow it to drop when the pressure from the lower end is relieved.

The valve consists of but four parts—a body, valve stem, cap and small spring to keep the valve stem in place, which, with the air pressure, keeps the stem in constant pressure against the body. One side of the valve is provided with a lug, by which it is attached to the lower ring of the hoist; the valve requires no packing, and is of such a construction as to be readily and cheaply repaired, although, after a constant service of over a year, no appreciable wear has been noticed. The parts of the hoist are all strong and substantial; all the parts submitted to strain are steel or wrought iron; the upper and lower heads are of cast iron, as is also the valve, the stem of which is carefully ground to a seat in the valve body.

The lifting capacities of these hoists, when 80 lbs. air pressure is used, are: 3 in. diameter, 450 lbs.; 4 in., 800 lbs.; 6 in., 1,800 lbs.; 8 in., 3,200 lbs.

The power is supplied by an air compressor, one of which is 6 in. to 8 in. in diameter, with a storage tank of about 3 ft. in diameter and 5 feet long, and will supply sufficient compressed air for 12 to 18 hoists having average use. For special purposes, such as where the hoist is used constantly, a less number can be supplied by a compressor of the above size. Hose is attached to the upper end of the wrought iron pipe, the length of the hose depending upon the floor area which it is desired the hoist should cover.

The advantages claimed for these hoists are the saving in time and labor over the ordinary block hoist, and the additional amount of work which their use will enable a tool to get through.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE signature to the correspondence, entitled "Purification of Gas," that appeared in the JOURNAL, for last week, on page 816, was unintentionally omitted. It was communicated by Mr. A. L. Allen, of Poughkeepsie, N. Y., under date of November 27th.

THE office of the Los Angeles (Cal.) Lighting Company has been removed to 457 Broadway, that city. President Cline is to be congratulated on the ease with which the change was made, but he always had the knack of causing matters over which he had charge to move along smoothly.

W. LE CONTE STEVENS, writing to Mr. Edward Weston, Vice President of the Western Electrical Instrument Company, Newark, N. J., says that the Weston Standard Voltmeter is held in very high esteem in Germany. At a lecture recently attended by him in the Polytechnic School, Zurich, the lecturer, who was a member of the Testing Commission, at the recent Frankfort Electrical Exhibition, said he had subjected the Weston Voltmeter to various rigid tests only to find it in the highest degree satisfactory—the best thing from America that was exhibited at Frankfort. As an illustration of the excellence of the magnet employed he stated that, an instrument having fallen accidentally upon the floor, its subsequent indications were not affected more than one-half of one per cent. by the mishap. We may also add that the shops of the Weston Company present a very busy appearance just now.

THE Greenville Gas Light and Fuel Company, of West Sunbury, Pa., has been incorporated by Messrs. John Tebay, John R. Atherholt and John A. McNary. It is capitalized in $20,000.

RECENT advices from Buffalo, N. Y., are to the effect that the Citizens Gas Company has bought from Mr. John Mayer a plot of land on Ferry street, paying therefor the sum of $18,000. The Company intend to erect on this ground a holder with a capacity of 500,000 cubic feet, which it is estimated will cost $75,000. The completion of this holder, which will not be begun until early in the spring, will give the Company a total capacity as to storage plant of one million cubic feet. In connection with this it may be stated that an agreement was recently reached whereby the Citizens Company's district was considerably enlarged. The annex comprises that part of the city bounded by Walden avenue on the south, Humboldt Parkway on the west, and Main street. The old territory is east of Main street and north of Seneca, running to North street, and from thence to the outlying territory.

THE Council of New Britain, Conn., has agreed to enter into a contract with the local Electric Light Company whereby the latter will carry on the public lighting of the place for a further period of two years. Prior to this the Council determined, by a vote of 8 to 7, to discontinue the special committee that had been intrusted with the duty of determining whether or not it would be to the best interest of the city to engage in the maintenance of a municipal electric lighting station.

AT the annual meeting of the Citizens Gas Light Company, of Willimantic, Conn., the following officers were elected: President, E. S. Boss; Secretary, Julius Pinney; Treasurer, O. H. K. Risley.

ON December 1st Mr. John P. Harbison entered on his 37th year in service of the City Gas Light Company, of Hartford.

A CORRESPONDENT at La Crosse, Wis., writing under date of the 5th inst., says: "I am glad to inform you that the authorities seem disposed to act fairly with the Gas Company in respect to sharing the expense of moving the gas mains from the center to the side of certain streets, where certain improvements on city account necessitate the changes in

the Company's distribution system. At a recent meeting of the Council the matter, which had been under advisement for some time back, came up on the presentation of a report submitted by Alderman Grover. The report stated that a number of conferences with representatives of the Gas Company had been held, and that as a result thereof it had been agreed to recommend that the expense of the removal be shared jointly by the Company and the city. A motion to adopt the report was amended so as to refer the matter to the Committee on Sewers, they to appeal to the City Attorney for his opinion respecting the legality of the settlement proposed. Those who ought to know whereof they speak assert that the opinion of the Attorney will coincide with that of Ald. Grover and the first committee.—R. S."

MR. JOHN C. TRAUTWINE, JR., Secretary of the Engineers' Club, of Philadelphia, desires us to say that all communications for the Society should be addressed to 1122 Girard street.

THE new offices of the Adams (Mass.) Gas Company, in the Collins Block, are much appreciated by those whose business causes them to call at headquarters, which statement virtually means that the new home is a decided improvement on the old one.

WE are indebted to "Observer" for the following, from the Hartford *Courant*, of recent date: "The Citizens Gas Light Company, of Willimantic, Conn., has just received two 50 horse power Otto gas engines, which are to be used (in connection with a 4-horse Otto starting engine) as a power source for driving the dynamos of the Company's electric light plant. The three engines weigh about 16 tons, and are remarkable for the solidity of their castings and their beautiful finish. As an auxiliary to these gas engines, in case of accident to the gas works and a consequent failure of the supply of gas, a 150-horse power steam boiler and engine will be placed in the station."

IT is claimed that ex-United States Treasurer J. N. Huston, who is also President of the Connersville (Ind.) Gas Light Manufacturing Company, is interested in the Harris gas process. As Mr. Huston always carried a very level head on his shoulders, we are inclined to doubt the statement.

THE proprietors of the Manchester (N. H.) Gas Company are making important extensions to their main system in the East Manchester district.

SOME time ago we reported that the City Council, of Toledo, Ohio, had finally fixed the gas rate in that city at $1.15 per 1,000 cubic feet, net, but it seems that such action, although agreed on, failed to become law, through some fine "objection." Now we are advised that the rate has been put at $1, net by vote of the Board of Aldermen, at a session held on the last day of November.

AT a meeting of the Fire, Water and Light Committee, of Winnepeg, Manitoba, it was decided that tenders be called for the electric lighting of the city at the expiration of the present contract. The Committee recommends that a rate per light per night be asked for not less than 100 arcs; also, a rate per light per night for each additional light over 100, the street plant only to be subject to be taken over by the city, at a valuation in the usual way, at anytime during the contract, and the contract—which is to be named to run originally for 5 years—to be terminated at 12 months notice. The tenders will not be received after noon of the 22d inst.

A CORRESPONDENT informs us that "The Indianapolis Gas Light and Coke Company versus the Philadelphia Trust Safe Deposit and Insurance Company, petition for the appointment of a Trustee" was the title of a case disposed of in Judge Taylor's Court, on the 2d inst. The declaration was to the effect that on July 1, 1879, the plaintiff executed a deed of trust to defendant and Francis M. Churchman, trustee, to secure payment of bonds to the amount of $450,000, the deed of trust covering real estate and other property, including franchises. The bonds are payable July 1, 1899, and there is now outstanding of the sum, $43,000. Francis M. Churchman was trustee of said deed of trust. He died August 23, 1891, and the Company's petition was for the appointment of a trustee to fill the vacancy so caused. The result of Judge Taylor's consideration of the matter was the appointment by him of Mr. John R. Pierson as trustee.

ON the 4th inst., through the filing of a bill by the proprietors of the Northwestern Gas Light and Coke Company, a temporary injunction was issued by Judge Tuley restraining the President, Board of Trustees and the Superintendent of Public Works of the village of Evanston, Ills., from interfering with complainants rights to use the public sewer of the village for drainage purposes. The Company avers that it maintains a gas works in the village, and that it has always conducted its business in a clean, wholesome and orderly manner. In common with other citizens it has connected its waste pipe with the public sewers, as it has a lawful right to do, for the purpose of draining its works. There is no ordinance in the village, it is said, which prohibits the Company from using the sewers for waters which were not of an offensive nature. On the 2d inst., the village authorities, without notice, and with an alleged wilful design to injure the Company, disconnected its pipes from the Evanston street public sewer and forcibly prevented a reconnection, which action, if persisted in would entail great loss on and hardship to complainant. Hence the action reported.

MR. L. A. ROWELL resigned from the service of the Nantucket (Mass.) Gas Company on NOV. 2. His present address is at Milton, Mass.

THE proprietors of the Holyoke (Mass.) gas works have put in an ammoniacal liquor concentrator. That it will pay a good return on the money invested goes without saying.

THE handsome new plant of the Memphis (Tenn.) Gas Light Company, which covers the entire square bounded by Main, Chickasaw, Mill and Greenlaw streets in that progressive city, was fired up for the first time on the 1st of the month. Construction work was begun last June, and the amount of money expended on the plant (including renewals and extensions of street mains) since then is little if anything short of $100,000. The new coal plant will be operated in connection with the Company's water gas station, the intent being to supply an illuminating and heating medium composed of three-fourths coal and one-fourth water gas. President Jones and Superintendent Lynn are to be congratulated on the complete success that attended their joint battles with the builders during the past six months or so, and the builders are justly entitled to credit for the faithful and precise way in which they carried out their contracts.

ATTENTION is called to the advertisement in this issue, inserted at the order of Secretary John W. Mish, of the Lebanon (Pa.) Gas Company. The Company asks for tenders for the tar to be produced on the works in the coming year. Tenders will be received up to 8 P.M. of the 30th inst.

THE Pittsburgh *Chronicle* says that the Allegheny County Light Company will perform the public lighting of the city, the contract for which was awarded on the 2d inst. There were four bidders. The Allegheny County Light Company's bid was $96 per year for arcs, $17.95 per lamp per year for gasoline lights and $18 per year for incandescent (20-candle power) electric lamps. The East End Electric Light Company bid $98 per year for arc lights, and its figures for gasoline and incandescent lights were identical with those submitted by the successful bidder. The Pennsylvania Globe Gas Company's bid on gasoline lamps was $18 per annum each, and the Sun Vapor Light Company offered to supply gasoline lights at $18.25 each. Last year the cost of the lighting, which was done by the East End Electric Light Company, was as follows: 1,158 arcs, at $100 each, $115,800; 100 arcs at $120 each, $12,000; 2,448 gasoline lamps, at $12, $29,376; 232 incandescent lamps, at $18, $4,176—a total of $161,352. Under the new contract all the arc lamps (1,258) will cost $96 each, or $120,768; 2,448 gasoline lamps at $17.95 each, will cost $43,941.60, and 232 incandescent lamps at $18 each, will cost $4,176—a total of $168,885.60. This shows an increase over the cost for the year 1891 of $7,553.60, but Chief Inspector Bigelow asserts that as he can replace 6 gasoline lamps with one arc, and the incandescent lamps, too, in like proportion, he will cause this substitution to be made as far as possible, with the result that the total figure per year under the new contract will be less than that for the year just closing.

SAMUEL MUIR, a florist of Chicago, brought suit against the Chicago Gas Light and Coke Company for $2,500, alleging that defendant's mains on Michigan street, on the line of which his conservatories are located, were in such leaky condition that the gas escaping therefrom damaged his plants, etc., to the amount sued for. The case was tried before Judge Kettelle and a jury, and the latter awarded plaintiff the sum of $650.

EVERYBODY in the gas business knows Mr. Sylvanus S. Townsend, General Agent in the East for the Roots Company's specialties; and, better still, everybody likes him. He is far from being a youth in years and his heart is not only in the right place, but it also beats with the vig-

or that comes from kindly impulse and honest dealing. He is also engaged in a partnership, the contract for which was drawn up by Cupid on December 8th, 1841, and the bonds of which are as strong to-day as when they were first executed. That this is so was pleasantly proven on the evening of Tuesday last, when Mr. and Mrs. Townsend received the congratulations of hosts of their friends, at their pretty home, 172 Clinton street, Brooklyn. Golden weddings in a golden lifetime are rare things in these days of ours, and the Townsend golden epoch was a shining one indeed.

MR. LITTLEHALES, of Hamilton, Ont., while on a recent visit to Montreal, was caught in the toils of a reporter for the *Witness*, and in the course of the interview Mr. L., in response to a query as to how gas lighting was progressing remarked that gas and electric lighting each had its special field, and that, light for light, gas was the cheaper, that it took as much coal to produce electric lighting currents as was used in producing an equal volume of light from gas, and that in countries with climates like that of Canada the heat from gas lights was an advantage instead of a defect. Mr. Littlehales further said that so far as he knew, every gas company in Canada was earning money for the proprietors thereof.

THE following extracts are taken from the report of Captain Lusk to the Commissioners of the District of Columbia: "Since the commencement of the current fiscal year the public gas and oil lamps have been lighted by schedules based upon a minimum of 3,000 hours per lamp per annum, or 400 hours more than those allowed for a number of years. While the increased period of illumination is in so far a gain to the public, it should be understood that in no other respect is Washington so provincial as in the practical dependence on the moon for a considerable part of each year's lighting. It is patent to all who use the streets at night that the result is entirely unsatisfactory, and that, on account of the foliage and the shadows cast by tall buildings, the sidewalks are too dark to be safely used during many nights when they are supposed to be adequately lighted by the moon. A sufficient remedy can be provided by fixing the minimum period of gas lighting at 3,750 hours per lamp per year, instead of 3,000 hours as at present. The Washington Gas Light Company is willing to undertake the service at $25.50 per lamp per annum—an increase of 18.6 per cent. in cost for an addition of 25 per cent. to the yearly period of illumination. During the fiscal year 1891 a count was made of all the lamps in service. This count developed the fact that a shortage of 124 lamps existed in the account of the Washington Gas Light Company. The difference was made good by the Company, to include as far back as the shortage could be traced. The matter is still under examination, with a view to ascertaining the exact cause of the discrepancy."

IT does seem that Captain Lusk called the thing by its right name when he said that Washington was provincial in the matter of adhering to even a partial moontable for the lighting of its streets. We would also submit that, should later day ideas eventually prevail there, the new lighting table ought to be framed on 4,000 hours per annum, instead of the 3,750 scheme suggested by Captain Lusk.

THE contest between the authorities of Wheeling, West Va., and the Natural Gas Company of West Virginia, has taken on a serious phase, and there is every likelihood that the Courts will be invoked to define the status of the parties in interest. When the Gas Company applied for and obtained at the outset an exclusive right to supply natural gas in Wheeling for a term of years, one of the clauses stipulated that the city should receive a free supply of gas for certain fuel purposes at the water works and the city garbage furnace. The supply was carried on for some time, but the Company, tiring of its duty in the premises, and it is said without notice, cut off the supply at the places named. By the advice of the City Solicitor the authorities renewed the connections, and placed a guard over them to prevent the Company from interfering. The Company seemingly acquiesced in the arrangement and the guards became careless "on watch;" but the former was only "playing possum," for at 3:30 A. M. of the 6th inst. a pipe gang succeeded in cutting out the connecting valves, while the city's sentinels slept. Later on the latter caused the arrest of the offenders, but they were subsequently discharged on the ground that there was no law under which they could be punished.

WE understand that the proprietors of the Clinton (Iowa) Gas Light and Coke Company have purchased the plant and franchises of the local State Electric Company. If this is so the Gas Company now controls the lighting field at Clinton completely.

WE are indebted to a Dubuque (Iowa) correspondent for the following respecting gas matters at Des Moines, Iowa: "About a fortnight ago the special committee appointed to investigate the gas supply of the city as at present carried on presented the following report, and also submitted the appended ordinance, all the proceedings being before the Board of City Council. The report and ordinance were:

"*To the Honorable City Council:* Your Committee, to whom was referred the forfeiture of the charter of the Capital City Gas Light Company, report that we have fully investigated and considered the charter in question and the extension of the pipes by said Company under its charter for the purpose of furnishing fuel gas to the inhabitants of the city. We find that the Company has not extended pipes to conduct this fuel gas as extensively or rapidly as it should have done to supply the people with this character of fuel, the Company excusing itself upon the theory that it would not be profitable to extend or enlarge its pipes. The charter of the Company seems to provide that it shall only extend the pipes when it is profitable to do so. The charter was granted on the condition that the Company should supply fuel gas at 60 cents per 1,000 cubic feet; but, instead of extending its pipes and furnishing fuel gas at the aforesaid price, it furnishes illuminating gas to the consumer for fuel gas at $1.50 per 1,000 cubic feet. A large number of people in the city have gone to the expense of providing themselves with the necessary appliances to use fuel gas, believing they would be supplied with the same at the price named in said charter, which has not been done. Your Committee are, therefore, of the opinion that said Capital City Gas Light Company has not complied with the spirit or intent of its charter, and that legal reasons exist which recommend that instead of at this time attempting to nullify or forfeit this charter that the price for supplying gas for fuel purposes be fixed by the Council. The city has been given this power by the Acts of the 22d General Assembly of Iowa. Your Committee, therefore, recommend the passage of the ordinance hereto attached fixing the prices of gas supplied for fuel purposes throughout the city, and in case the Capital City Gas Light Company fails to comply with the ordinance the Council should then promptly take such further action as may be thought advisable in the premises." [Signed by the Committee.] Then follows the ordinance:

"*An ordinance to regulate the price of fuel gas and gas used for fuel purposes.*—Be it ordained by the City Council of the city of Des Moines:

"Section I.—That every person, firm or corporation furnishing to the inhabitants of the city of Des Moines fuel gas or gas used for fuel purposes shall be entitled to charge and receive for such fuel gas or gas used for fuel purposes, the following prices, and no more, viz., 60 cents per 1,000 cubic feet.

"Sec. II.—If the consumer shall pay to the person, firm or corporation furnishing such gas, the bills for gas consumed within five days after the bill for such gas has been presented, there shall be allowed on such bill, to all consumers using less than 10,000 cubic feet per month, a discount of 10 cents per 1,000 cubic feet, and to all consumers using 10,000 or more cubic feet per month, a discount of 15 cents per 1,000 cubic feet.

"Sec. III.—All ordinances or parts of ordinances inconsistent herewith are repeated.

"Sec. IV.—This ordinance shall take effect and be in force on and after its passage and publication as provided by law."

When these had been read to Council, a motion to adopt the report was carried, whereupon Ald. Sherman moved a suspension of the rules to permit a second reading of the ordinance, which was agreed to. Ald. Sherman then asked for a further suspension to send the ordinance on third reading. A snag was here encountered in the shape of the adverse votes of Alds. Tone, Rollins, Lane and Sheldon, who objected to the undue haste with which the measure was being attended. As their votes were necessary to the obtaining of consent for a suspension of the rules, further consideration was postponed. This is our present knowledge of the state of the case.

PRESIDENT J. W. STRATTON of the Valparaiso (Ind.) Gas and Electric Light Company has just succeeded in securing from the City Council an extension of the street lighting contract for ten years from the expiration of the present contract (or until November 21st, 1902), at the same rate now paid. The only concession granted was an agreement whereby the city has an option to purchase the arc light plant at any time during the existence of the contract, at a price to be established by three appraisers; but as the city's indebtedness already exceeds the constitutional limit, and is growing, this contingency appears rather remote. As this contract was secured against the strong opposition of a competing company that offered to perform the service for $10 per lamp per

annum less, Mr. Stratton must be put down as a strategist of the first rank. If the gas men of this country do not allow themselves to become over-anxious, holding as they do "the long end of the rope," to say nothing of their staying powers, they will in the long run teach some of the electrical enthusiasts a lesson that will be worth their remembering. At any rate a few more chapters like the Valparaiso one will be read with interest.

THE Bridgeton *News* says that "The very high ruling prices for Bridgeton gas stock are complimentary to the economical, business like administration of the affairs of this Company. Superintendent Harding is eminently the man for his position, and he has most excellent assistants. Despite the advance of electric light in popular favor, the gas stock becomes more and more prized; and this, too, without oppressing the customers. The quality is good and the price moderate. If all business affairs in Bridgeton were managed as well as those of the Bridgeton Gas Company, 'twould be a subject for congratulation." To all of which the JOURNAL gives its unqualified indorsement.

THE incandescent electric lighting service at Yonkers, N. Y., is about as wretched an attempt at artificial lighting as is to be found in the State.

THE suit brought some time ago by Mrs. Mary S. Foote against the Burlington (Ia.) Gas Company, on the ground that the smoke from defendant's works took from the value of her house—it is close by the gas works—as a place of residence, has been compromised by a small money payment and a guarantee that the cause for complaint shall be removed

SECRETARY SCRIVER, of the Montreal Gas Company, estimates that the Company will expend $150,000 during the year 1892 in plant improvement.

Foundations and Floors for the World's Fair Buildings.

In a paper read before the Western Society of Engineers, by Mr. A. Gottlieb, who at one time acted as Chief Engineer of Construction for the World's Fair Commission, the following remarks respecting the foundations and floors for the Exhibition buildings were made:

The World's Columbian Exposition, as is well known, will be at Jackson Park, one of the public parks of Chicago, the use of which was granted under the express condition that all buildings erected there must be removed after the Exposition closes, and the park restored to its original condition. This means, in other words, the buildings will be in actual use for six months only, and then removed, being temporary structures in the strictest sense of the word. This fact naturally must be considered in the plans devised, as after six months use the bulk of the material must go to waste. The vast area to be covered by buildings (over 100 acres) required more care with reference to economy than is necessary in ordinary sized buildings, as any needless expense multiplies itself so enormously in those extraordinarily large surfaces.

The natural formation at Jackson Park before the grading was done was mostly low ground from + 0.5 to + 11 feet above city datum; the average for about 300 acres was + 3.5 feet. The southern and the eastern parts were the lowest, the western part being the highest ground. City datum is the low water line of 1847, and the stage of the water in the lake for the last year was about 1 foot above datum. The highest stage ever observed for the last 50 years was 4 feet above datum, except occasional tidal waves.

By excavations from the high ground and dredging of lagoons material has been obtained to fill up the low grounds, so that the grade under buildings is at least 5 feet above datum, and the ground outside of buildings 6 feet above datum, with the exception of the terraces around the buildings, and the lake shore drive, which are from 10 to 12 feet above datum. The material of the fill is sand throughout. Borings in various parts of the grounds show the formation to be very uniform, as follows: About 5 to 8 feet sand; 4 to 10 feet quicksand; 6 to 10 feet soft clay; 6 to 10 feet clay, and then hardpan. The average depth below surface of the hardpan is from 26 to 36 feet. An exception to this is to be found in the higher locations, where the top layer of sand has a greater depth, and in the northwest corner of the Agricultural Building, and the southern half of the Manufacturers and Liberal Arts Building, where deep mud holes prevail, hardpan 30 to 45 feet below surface.

I had first intended to have pile foundations under all buildings, and piles driven for the floor supports. Before this was adopted, however, test piles were driven in different locations, partly to hardpan and partly to a lesser depth, and heavily loaded with sand. At the same time platforms of 3-inch planks were constructed, placed in different locations, on top of the sand, and loaded uniformly with pig iron, about 2½ tons per square foot. These platforms were loaded gradually, and the settling carefully noted under each load. The loads remained for several days and were then transferred to other platforms. It was found that under the maximum loading the settling was very small, about three-eighths of an inch, and very uniform, and that after this settling had once taken place, the increase of load up to 2½ tons per square foot caused no perceptible increase in settlement.

Platforms loaded on top of sand filling over the mud holes above referred to, sank from 1 to 3 feet under a load of 1½ tons per square foot, and kept sinking the longer the load remained on. It was thereupon determined to use pile foundations in these locations, and everywhere else where the formation was favorable, platform foundations so proportioned that under a maximum load from buildings or from floor loads the pressure upon the ground would not exceed 1½ tons per square foot.

These platform foundations consist of 3-inch pine or hemlock planks, with blocking on top, to distribute the pressure from loads uniformly over all the planks, and to furnish support for the posts which carry the caps supporting the floor joists and posts of the buildings. The blocking was to be well spiked to platform planks and posts, and caps and sills drift bolted.

The general floor loads for the various buildings were adopted as follows:

Fisheries Building	100	lbs. per sq. ft.
Manufacturers and Liberal Arts Building	100	"
Agricultural Building	100	"
Machinery Building	200	"
Electricity Building	100	"
Mines and Mining Building	150	"
Machinery Annex	200	"
Horticultural Building	100	"
Women's Building	100	"
Transportation Building	150	"
Galleries	80	"

These are general floor loads only, intended for the aisles in the buildings, and for the lighter exhibits of each branch. Where heavy exhibits, machinery or tracks were to be loaded, the supports and floors to be reinforced as required, when the weight and character of the exhibits, and their exact location in the buildings, will be known.

In proportioning the sizes of foundations and floors, to resist the maximum strains from above loads, I have recommended to adopt the following unit strains: For bearing of vertical posts upon underlying blocking (head or end of fiber upon transverse fiber) 600 pounds per square inch; tension in extreme fiber in caps and joists, 1,500 pounds per square inch.

Coming to the statement of Professor Lanza, that it is better engineering to proportion floor beams with reference to their deflection, than to the ultimate strength, I have computed the deflection of a 2 × 12-inch joist, 14 feet between supports, if loaded so as to produce a fiber strain of 1,500 pounds per square inch, using the modulus of elasticity of Professor Lanza, 1,332,451 for green timber, and find the deflection to be 0.63 inch, equal to $\frac{1}{267}$ of the length, with the modulus as found for material seasoned without being subjected to loads, being 1,600,000, the deflection would be 0.45 of an inch, equal to $\frac{1}{378}$ of the length.

Most of the spans of joists in the Exposition Building are from 11 feet 6 inches to 12 feet 6 inches length; some few exceptions are over 14 feet length.

In recapitulating, I will briefly summarize the result of the various tests, and the conclusions I have arrived at:

1. That the use of spread foundations upon the sandy bottom with clay substrata, as adopted, was warranted by the tests made with loaded platforms.

2. That the adoption of a strain of 600 pounds per square inch for pressure of posts of foundations upon the blocking timbers, producing an indentation of less than $\frac{1}{100}$ of an inch, would be justified even for permanent structures.

3. That the timber in floor joists and caps of posts, under the circumstances mentioned, must be considered as timbers seasoned, at the time when they will be called upon to do service; and seasoned without being subjected to loading.

4. That by using a working strain of 1,500 pounds per square inch in the parts above named, if the tests results of Professor Lanza, for seasoned timber are accepted, a factor of safety from $4\frac{8}{10}$ to $5\frac{8}{10}$ is obtained; that if the results of the Watertown Arsenal are accepted, the factor of safety obtained from the 14 seasoned specimens show a factor of safety of $5\frac{1}{10}$. If the test results as given by Trautwine, Rankin, Hatfield and Laslett are accepted, the factor of safety would be still larger,

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	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	97¼	97½
Central	500,000	50	—	90
" Scrip	220,000	—	95	100
Equitable	4,000,000	100	122	126
" Bonds	1,000,000	—	106	108
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	110	115
Mutual	3,500,000	100	120	122
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	—	—
" Bonds	150,000	—	—	100
Standard Gas Co—				
Common Stock	5,000,000	100	34	37
Preferred	5,000,000	100	80	85
Yonkers		50	112	—
Richmond Co., S. I.	346,000	50	—	—
" Bonds	20,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	116	—
Citizens	1,200,000	20	80	82
" S. F. Bonds	320,000	1000	—	103
Fulton Municipal	3,000,000	100	118	—
" Bonds	300,000		102	—
Peoples	1,000,000	10	66	—
" Bonds (7's)	368,000	—	100	—
" " (6's)	94,000	—	100	—
Metropolitan	870,000	100	97	—
" Bonds (5's)	70,000	—	100	—
Nassau	1,000,000	25	128	—
" Ctfs	700,000	1000	100	—
Williamsburgh	1,000,000	50	114	—
" Bonds	1,000,000	—	107	110
Out of Town Gas Companies.				
Boston United Gas Co.—				
1st Series S.F. Trust	7,000,000	1000	84	86
2d " " "	3,000,000	1000	70	74
Bay State Gas Co.—				
Stock	5,000,000	50	50½	51
Income Bonds	2,000,000	1000	98	102
Buffalo Mutual, N. Y.	750,000	100	105	110
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	155	160
" " Bonds.	45,000	—	—	—
Chicago Gas Company.	25,000,000	100	63½	63¾
Chicago Gas Light. & Coke Co.—				
G't'd Gold Bonds	7,650,000	1000	85¼	85½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1000	—	97½
People's Gas and Coke Co., Chicago—				
1st Mortgage	2,100,000	1000	—	100
2d "	2,500,000	1000	—	95
Consumers Gas Light Co., Jersey City	2,000,000	100	12	15
Bonds	600,000	1000	70	75
Cincinnati G. & C. Co.	7,000,000	100	—	200
Consumers Toronto	1,000,000	50	169	172
Central, S. F., Cal			90	—
Capital, Sacramento, Cal			58	
Consolidated, Balt.	11,000,000	100	43	43½
" Bonds	6,400,000		107	107½
Citizens Gas Lt. Co., Rochester, N. Y.	500,000	—	85	110
Bonds	250,000		—	—
East River Gas Co., Long Island City	1,000,000	100	100	105
Bonds	500,000	100	100	102
Hartford, Conn	750,000	25	120	128
Jersey City	750,000	20	180	200
Louisville, Ky	2,570,000	50	125	130
Little Falls, N. Y.	50,000	100	—	106
" Bonds	25,000	—	100	103
Laclede Gas Light Co., St. Louis, Mo.—				
Common Stock	7,500,000	100	19⅞	20
Preferred "	2,500,000	100	—	—
Bonds	9,034,400	1000	80	80½
Montreal, Canada	2,000,000	100	200	208
Memphis (Tenn.) Gas	750,000	100	40	—
" Bonds.	240,000	100	103	—

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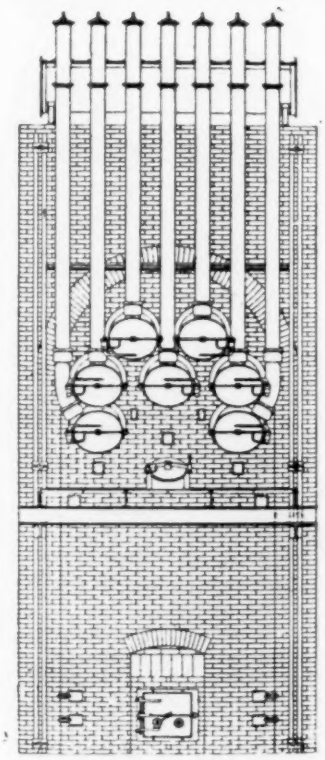

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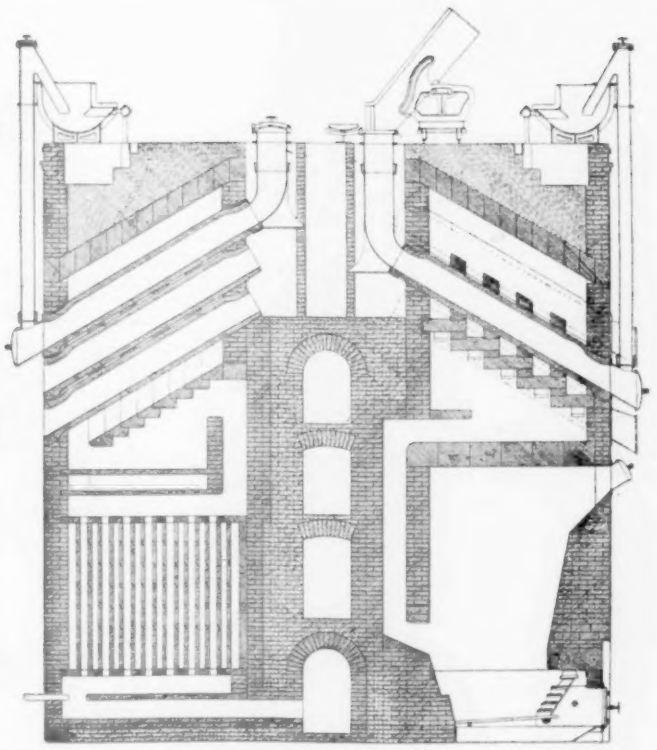

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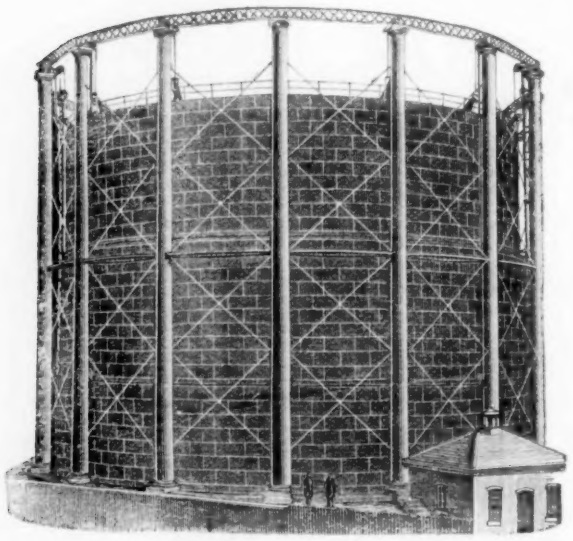

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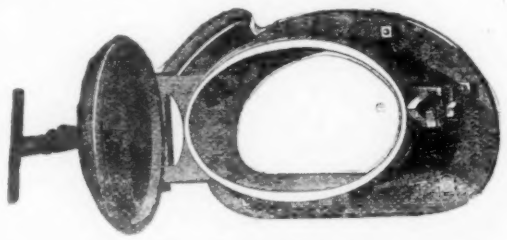

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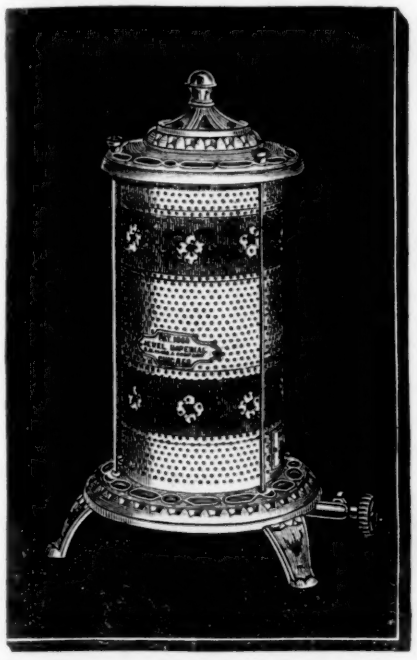

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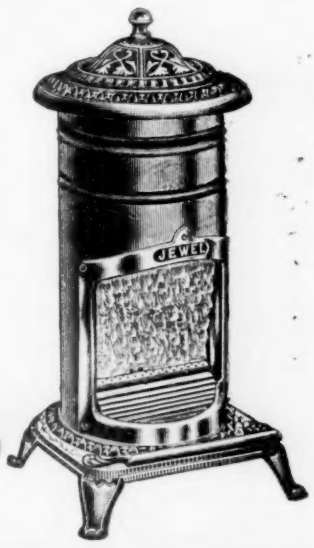

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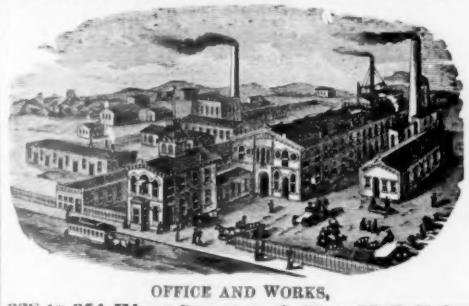

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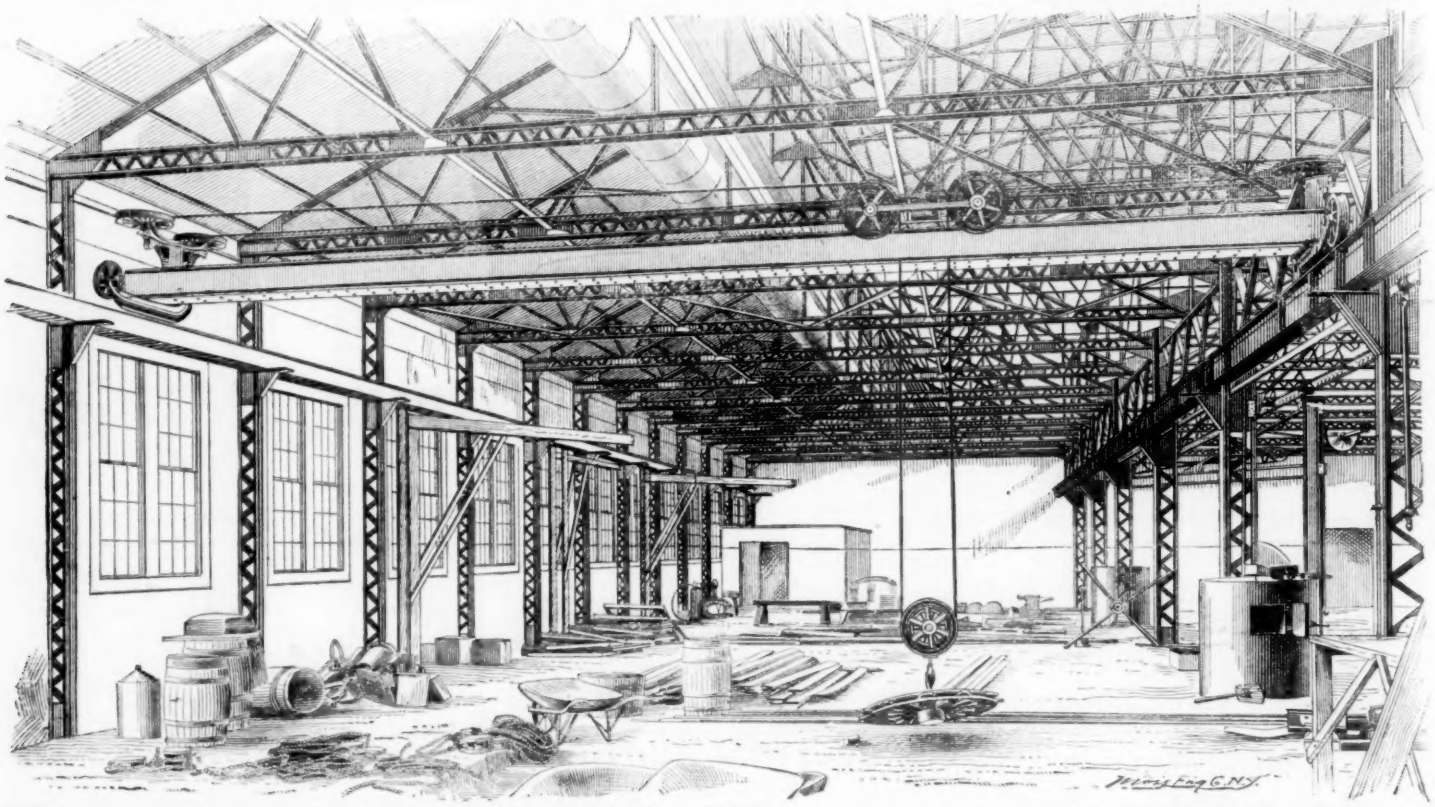

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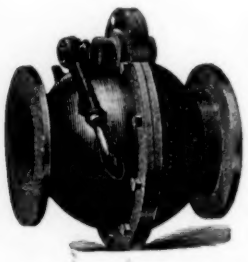

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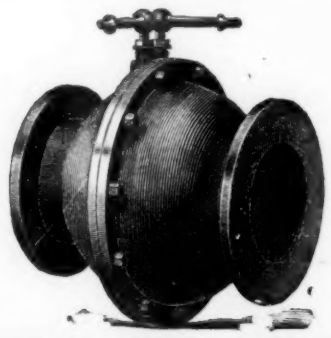

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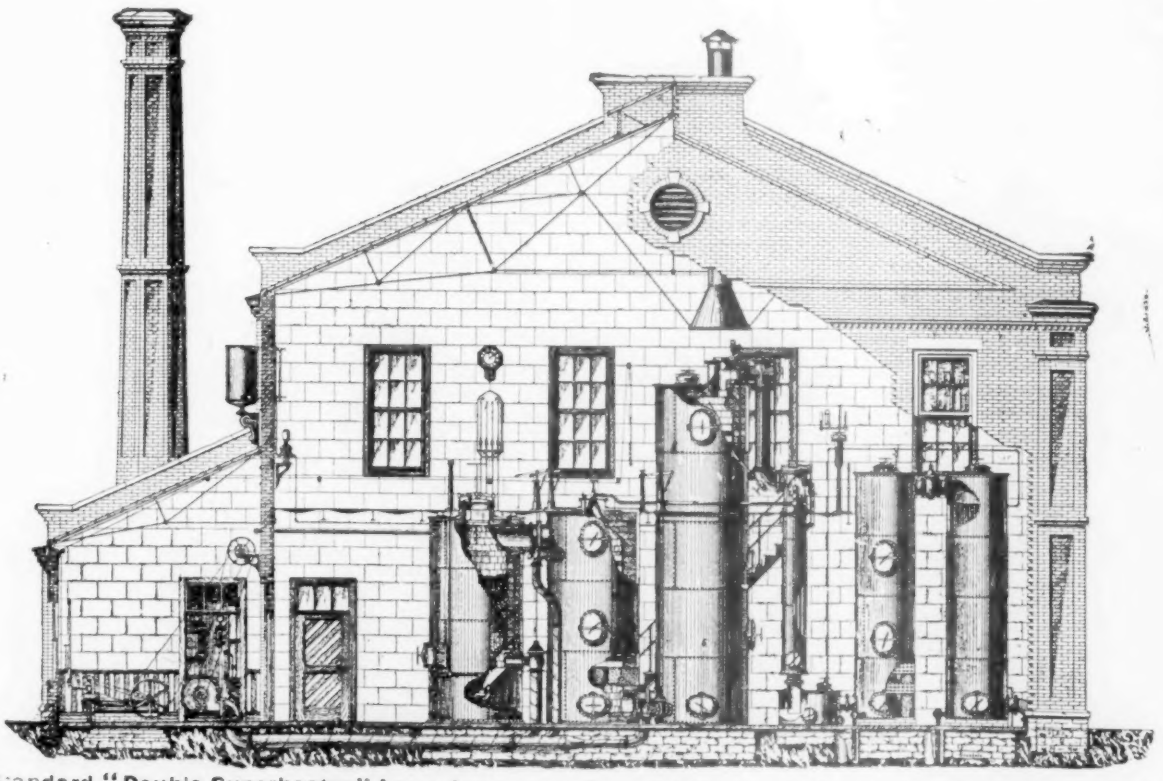

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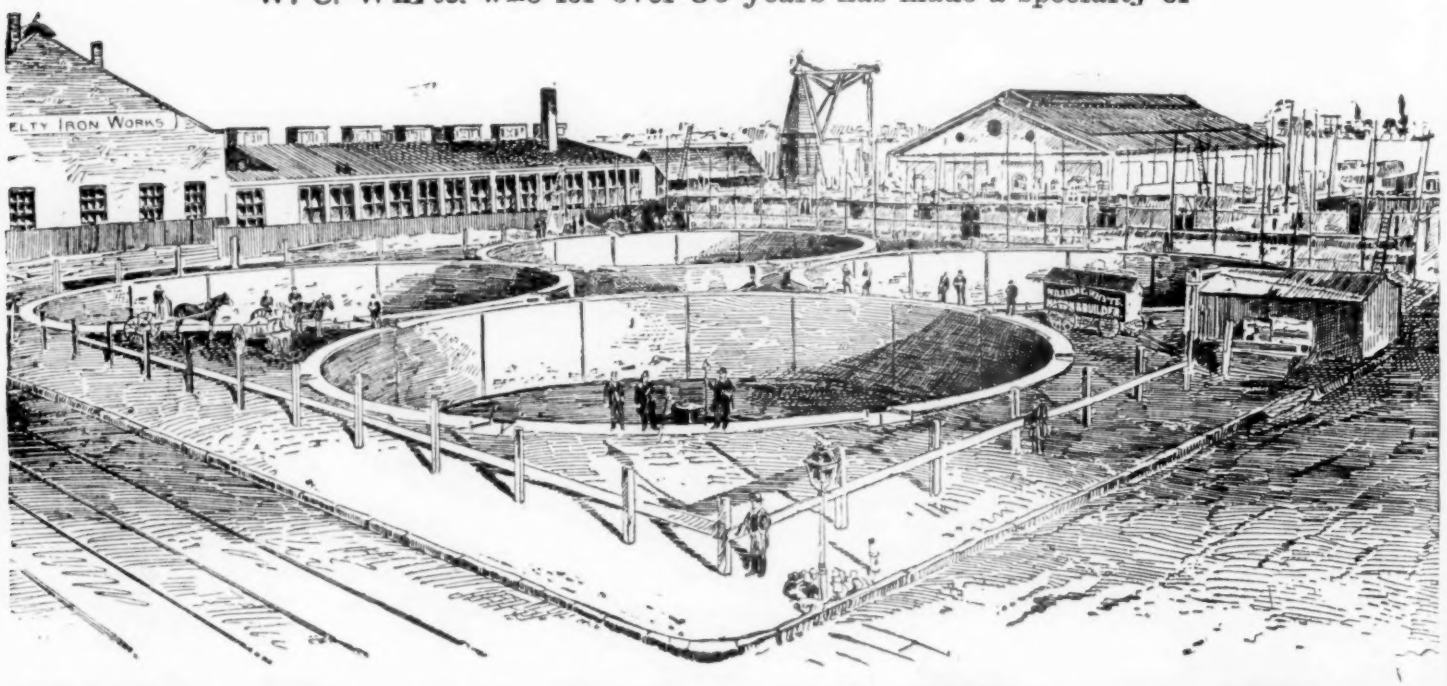

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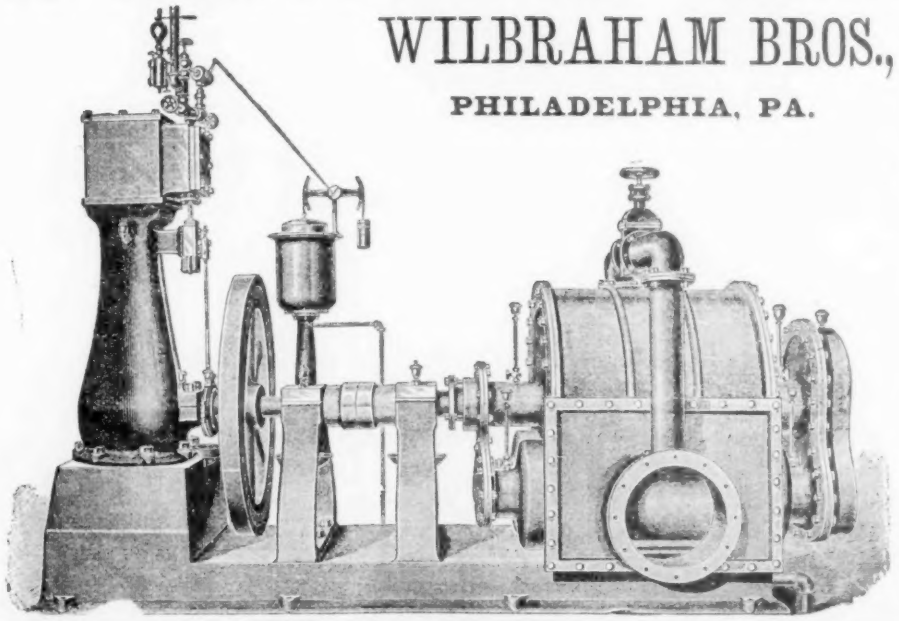

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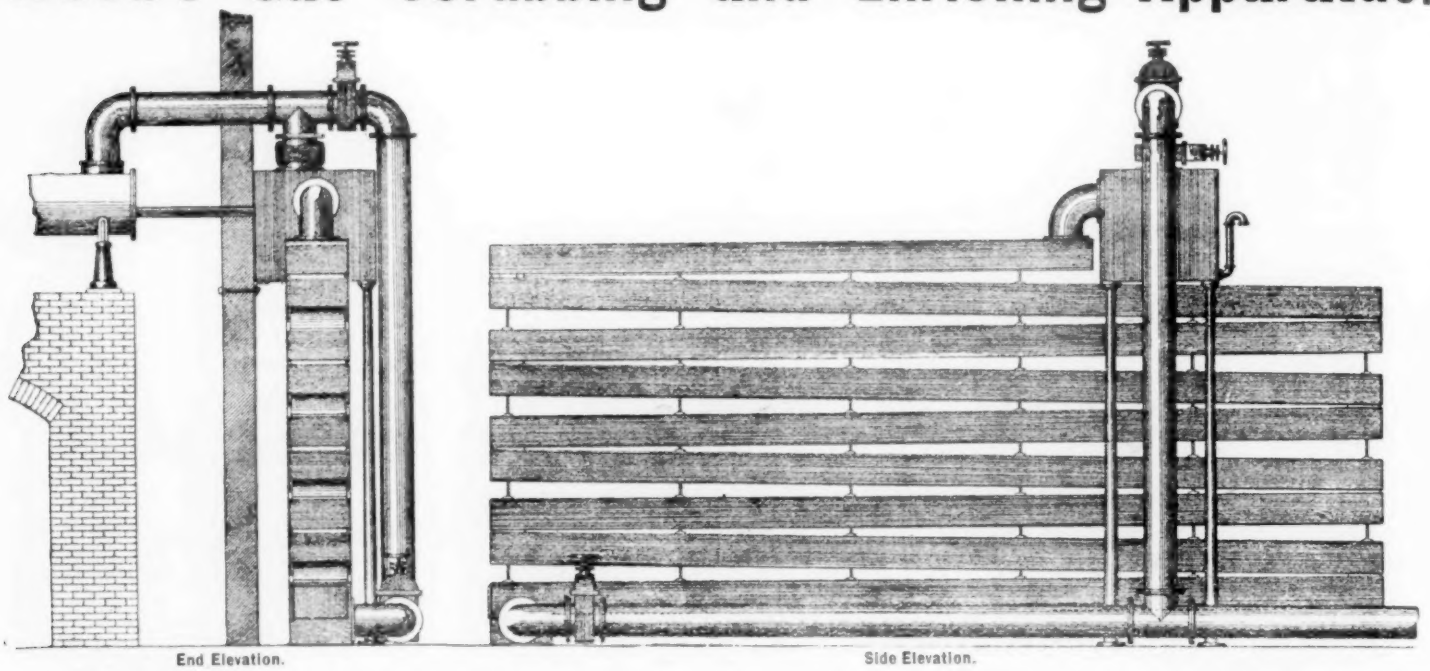

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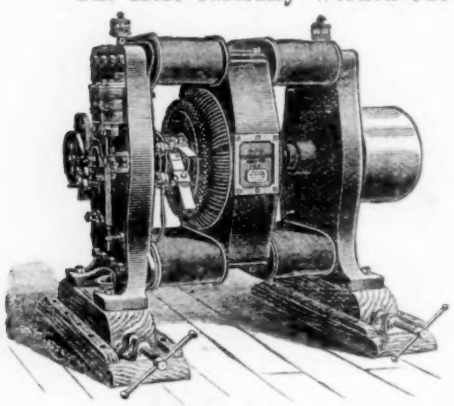

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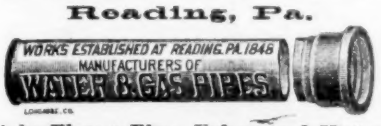

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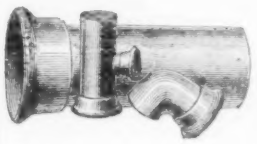

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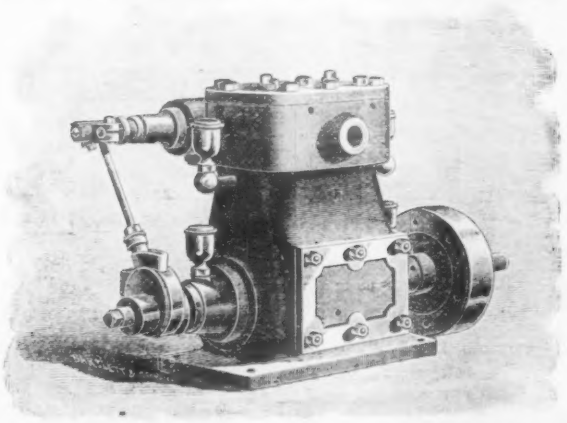

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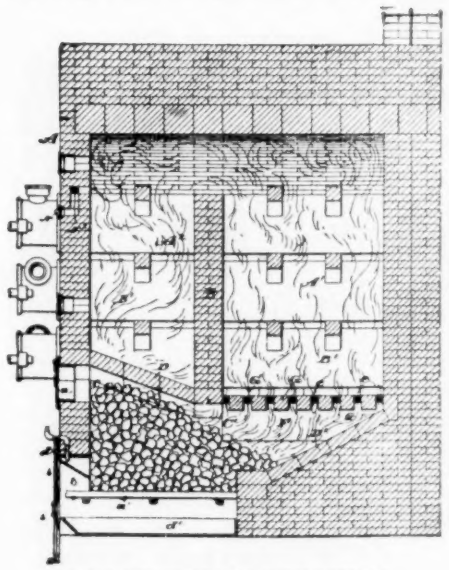

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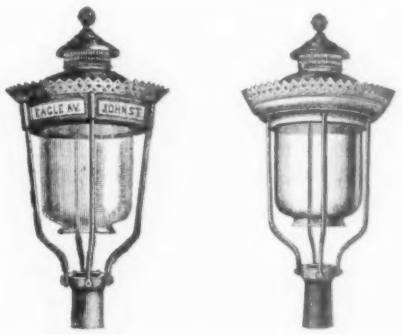

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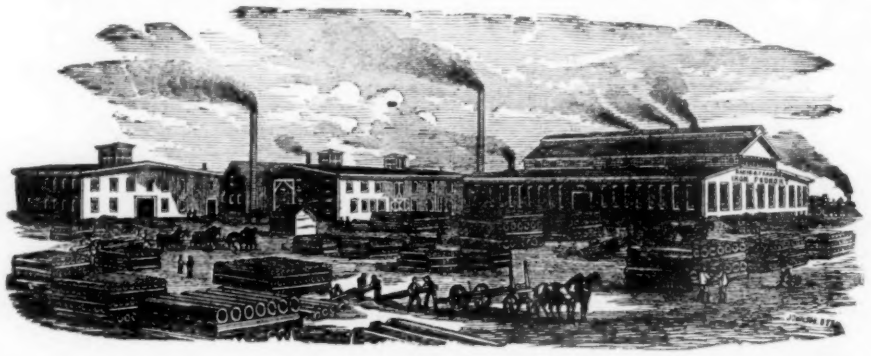

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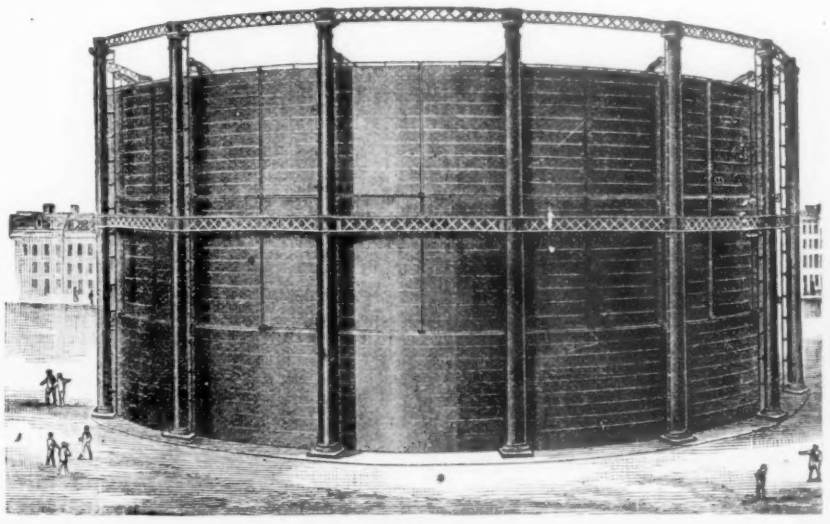

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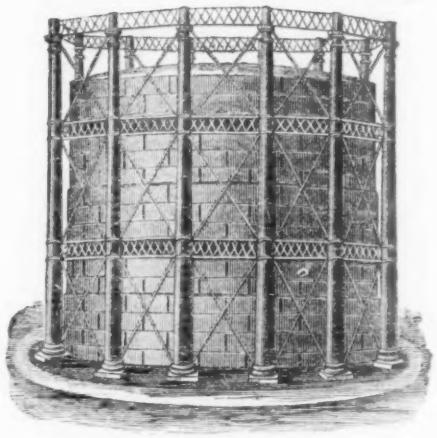

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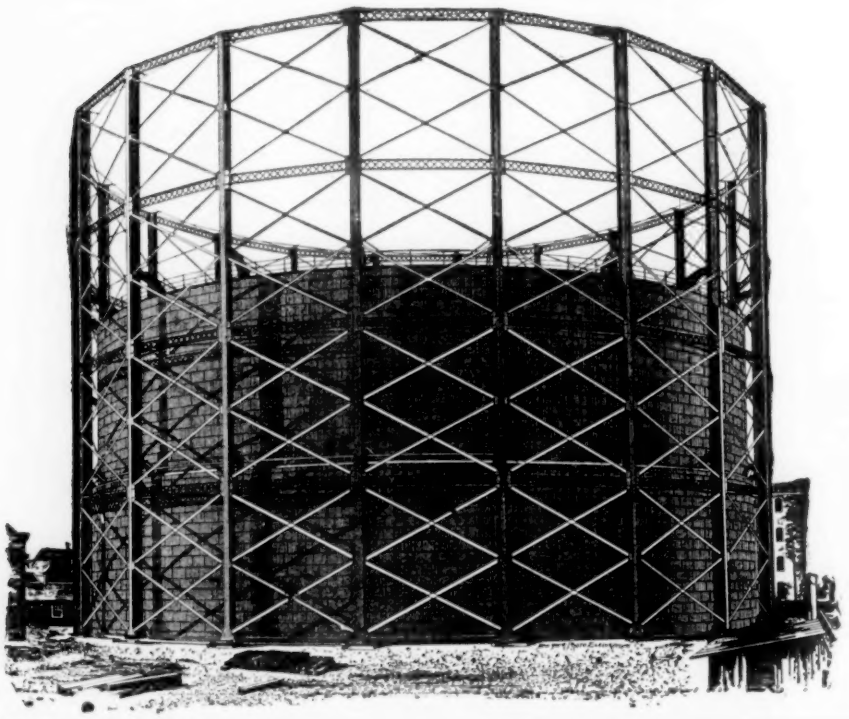

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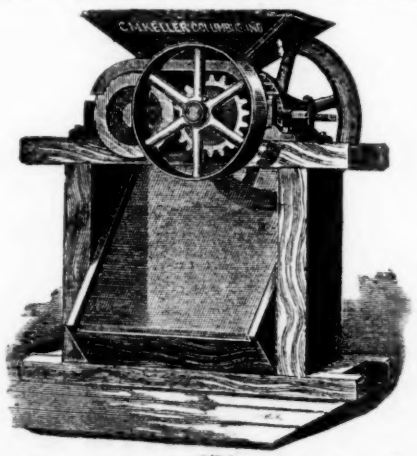

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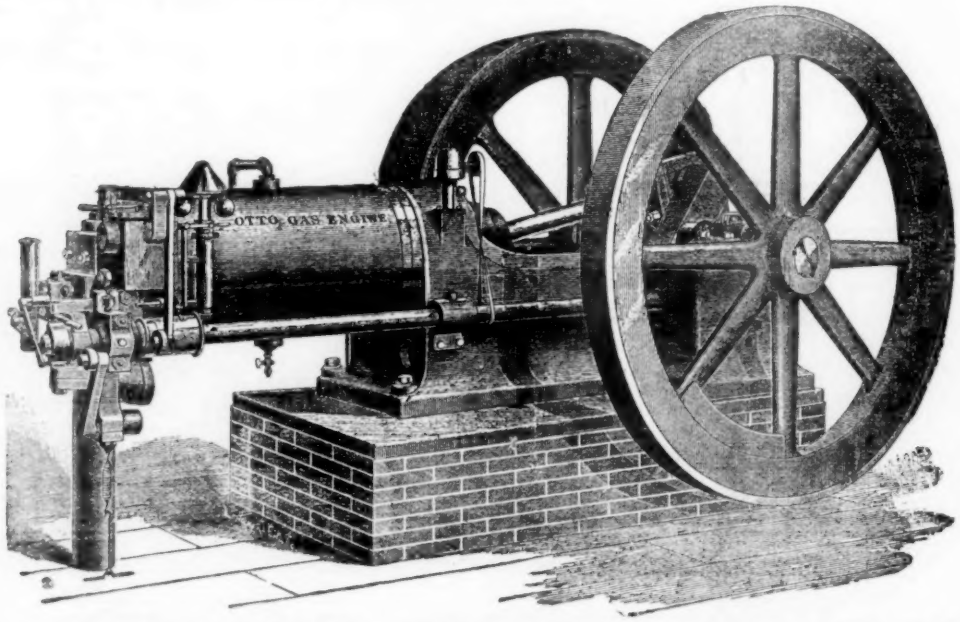

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